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ESPIRITU SANTO, NEW HEBRIDES: *A paper read at the Evening Meeting of the Society on 10 December 1934, by*

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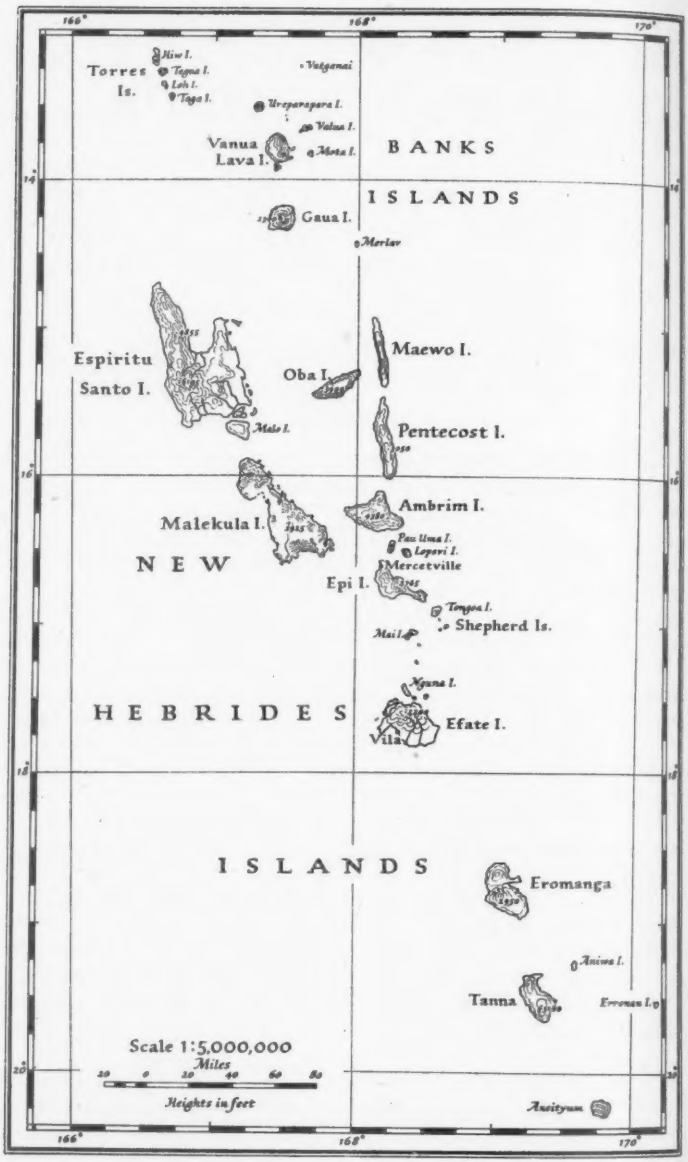
THE Oxford University Expedition to the New Hebrides arrived in the island of Espiritu Santo at the beginning of September 1933. It was made under the auspices of the Oxford University Exploration Club, and received a great deal of help from its Chairman, Mr. Charles Elton. We had two very definite main objects, namely (1) to make a study of the breeding seasons of animals in a climate which scarcely varies during the course of the year; and (2) to discover which is the highest mountain in the New Hebrides, to climb it, and to survey the whole surrounding district. It is not always easy to collect money for scientific expeditions, but I was much fortified in my various applications and rebuffs by remembering that our famous forerunner, Quiros, had sent in no fewer than fifty-one "memorials" asking for support for his proposed second visit to these islands. In the end my efforts were very successful, for we have had the support not only of this Society, but also of the Royal Society, the University of Oxford, New College, and the Percy Sladen Trust, to all of whom we are very grateful. My brother, Mr. S. J. Baker, has helped us not only financially and by the loan of surveying instruments, but also by instructing us in surveying before we left England, and by drawing the map from our survey. The John G. Paton Mission Fund very kindly lent us a motor boat.

The following were the members of the expedition: Mr. Terence Bird (zoologist and surveyor), Mr. Tom Harrisson (ornithologist), Mr. A. J. Marshall (naturalist), Miss I. Baker (botanist), Mrs. Z. Baker (photographer), and myself (leader).

In a previous paper before this Society I have given a general description of the New Hebrides, and now I must only state briefly that they are a group of islands in the tropical Pacific, clothed with luxuriant vegetation, inhabited by woolly-haired, dark brown natives, with a sprinkling of French and British planters, traders, and missionaries round the coast. The natives of the interior of Espiritu Santo are scarcely influenced by the white people on their shores, and there are few places in the world to-day where primitive society can be



New Hebrides and Banks Islands

studied so well as in the interior of Espiritu Santo. The semi-civilized natives of the coast can speak that remarkable language Pacific Pidgin English, a language of which I can never grow tired. Often it comes to one's rescue when one is depressed. One night, alone with my carriers in the unexplored mountains, we turned some pigs out of a wretched leaking shelter so that we might lie down in the filth to sleep. The odometer had broken, and it looked as though the whole survey was going to be a failure. Mournfully I inflated the rubber cushion which I always carry to encourage sleep, even when every ounce is significant. Jimmy noticed it for the first time. "Oh, master," he said, "'im 'ere brother belong football." On another occasion, when I was really alarmed, as you will hear, for the safety of Harrisson and my wife, I was covering large distances every day in continuous rain, in a futile attempt to reach them. Lying down one night in the usual filth of a native house, with Ngisa close beside me, among all the savages, I was tremendously cheered by a little conversation. Apropos of nothing, Ngisa asked, "Bushman 'e stop along England?" He was asking me whether there were savages in England. "No got," I answered. Ngisa pondered for a while. "I t'ink along England 'e no got bush."

Some of the finest men I know are New Hebridean natives. I should like to give a brief picture of three of them. First, Taw-waw-liwo, a grand old man of the mountains, one of nature's gentlemen, one of the most unobtrusive, dignified characters I have ever met in any part of the world, despite his almost complete lack of clothes. At difficult places in the mountains, or in the swirling waters of the torrents, there he was, unobtrusively, close to us, ready to help, yet never suggesting our inefficiency. Then Karai, small, ugly, ill-developed, yet the most recklessly brave man I know. A tree projects out from a precipice: he runs up it without using his hands. We come to the river; great boulders form its banks. He rushes from boulder to boulder, when a false foothold would mean a broken leg, and dives headlong into the fastest portion of the stream. He is a man who makes one imitate him. Even I have to crawl gingerly out along that wretched tree-trunk over the abysm; even I have to trust myself among the boulders and rushing water of the mountain torrent. Lastly, Nebv, the quiet, kindly, ferocious-looking chief of my wife's village. Hospitality itself, he opened up his village to us, made a house for my wife without saying he was going to do it, and helped us in every way at his disposal. When he came to visit us at our base camp at the shore, we sometimes gave him a little silver to exchange at the store. Shortly before we left, our native boy told me that Nebv wanted to make a presentation to me. I could not imagine what it was going to be, nor shall I ever forget what it was. With the proud air of one who consigns his whole worldly wealth (for such it was) to some one else, he presented me with a two-shilling bit.

As I stressed in my previous paper before this Society, it is above all important that the savage inhabitants of the New Hebrides should be left alone as far as possible by whites. It is mainly the gradual spread of introduced diseases that is killing them off. They are worth saving as a people leading a really primitive life, with little outside influence. It was with great regret that we learnt that a large liner had put in to Hog Harbour on a cruise. The savages collected on the shore, but, I am glad to say, fled when the tourists

came off. If they had stopped, and had been persuaded to dance for the tourists, it would have been the beginning of the break-up of their culture, in which dancing plays a very important part in connection with chief-making. The prostitution of their culture by tourists would be deleterious not only to themselves but also to social anthropology.

It has been mentioned that one of the chief objects of the expedition was the study of the breeding seasons of animals in a climate which varies very little during the course of a year. We set up an elaborate meteorological station at Hog Harbour, designed to measure the climate as it effects animals and plants: that is, we studied climate from the point of view of the biologist. Maximum and minimum temperatures were taken daily, not only under standard conditions of exposure, but also in the forest, where we had a special station at which daily readings were made of humidity and of the cooling power of the atmosphere as shown by the wet and dry bulb katathermometer. A Livingston evaporimeter was also set up in the forest, but so little evaporation takes place in that humid region that only monthly readings were necessary. Sunshine and rainfall and grass-minimum temperatures were measured in the open with standard exposures. Measurements of ultra-violet light were made with the tubes exposed in a new way. Barometer readings were also made. Bird and I standardized a method of measuring twilight on moonless nights, which would, we believe, give interesting results if tried in different parts of the world. A blackboard with a white circular patch painted on it in enamel paint was erected vertically facing west in an open space. The observer stood 20 metres away and noted the time at which it became no longer possible to see the white circle steadily. We found that different observers only differed by a few minutes. The enormous mass of meteorological data will take some time to analyse, but it is clear that the seasonal variation in climate is small. There are many regions in the world where temperature does not vary very much during the year, but in these there are nearly always distinct wet and dry seasons. Here, in the Northern New Hebrides, it is always hot and wet.

We chose five animals for a detailed study of breeding seasons, and made dissections of well over three thousand specimens in order to report monthly on the state of their reproductive organs. This material will also take a long time to analyse, but it is already clear that the fruit-bat (*Pteropus geddiei*), the insectivorous bat (*Miniopterus australis*), and the passerine bird (*Pachycephala intacta*) all have well-defined breeding seasons. We have not yet finished the work on the parrot (*Trichoglossus*). The lizard (*Emoia cyanura*) breeds all the year round, though not always equally fast. In addition to these five, which we studied intensively, Mr. Harrisson made a wide survey of the breeding habits of the birds, and found a distinct breeding season in most cases. My sister made a study of the flowering seasons of plants and found two main flowering seasons. In this continuously moist, hot climate, it is a surprising fact that one tree, *Garuga sp.* (probably new), casts every leaf at the same time annually. A leafless tree sticking up in the middle of the rain forest is a most incongruous sight.

My sister used constantly to notice a stream of horseshoe bats (*Hipposideros cervinus*) flying in single file across the path when she went to take evening

Chief-making ritual, Sakau: a pig is formally presented to the chief, who is seen in the background performing a ceremonial dance

Later stage in the same ritual: pigs killed by the man rising in rank

Sakau boy

All phots. by Mrs. Baker

Mount Tabwemasana from the west

Mount Tabwemasana from the north-west

Garuga sp., the only regularly deciduous tree in the New Hebrides

meteorological readings in the forest. There were over four hundred of them in the line. They followed exactly the same path every night. We gradually followed their line of flight back, night after night, but could only get a short way each night on account of the rapidity with which the four hundred bats passed one as one traced their line. Eventually we were led to the cave in the coral rock where they live during the day. The brush turkeys (*Megapodius layardi*) lay their eggs, not in piles of leaves like their Australian relatives, but in deep holes hollowed in the ground which they afterwards fill up with loose earth, sticks, and leaves. My wife measured an egg at 37 inches below the surface of the ground. It is difficult to understand how the eggs respire and how the young escape. We kept some young ones taken from underground in the laboratory, and learnt a little which helped us to understand the method of escape. At first they were so weak as not to be able to stand, and did not eat. Then one day one of them suddenly went mad and made the wildest attempts to escape. The extremely interesting thing to notice was that its vigorous efforts were all directed upwards. The furious upward urge was most curious to observe. The bird escaped from the cage and immediately took flight and was lost. The other youngsters repeated this behaviour at intervals.

The second object of our expedition was to discover which was the biggest mountain in the New Hebrides and to climb it and survey the whole region. The large mountains of western Espiritu Santo have attracted the attention of all explorers. The map made by Torres on Quiros's expedition of 1606 shows them clearly and amusingly enough with trees many hundred feet high on top of them. Bougainville saw them again in 1768, and depicts them quite well, even showing the little patch of low ground round Wus. He says of them, "Au-delà de cette pointe les terres revenoient au Nord-Nord-Ouest, & s'étendoient à perte de vue, terres d'une élévation extraordinaire, & qui présentoient au-dessus des nuages une chaîne suivie de montagnes." It is worth mentioning that although Bougainville proved Espiritu Santo to be an island by sailing to the south of it, yet he did not himself know that this was the island whose north coast had been discovered by Quiros. He thought that the stretch of water between the island of Omba[1], Pentecost, Ambrim, and Malekula was the bay of San Felipe and Santiago of Quiros. It was Captain Cook in 1774 who showed that Quiros and Bougainville had touched on opposite sides of the same island. These facts have escaped the attention of writers about the New Hebrides. Cook saw the large mountains, and says of Espiritu Santo, "The land of it, especially the west side, is exceedingly high and mountainous; and, in many places, the hills rise directly from the sea."

The island of Espiritu Santo has been surveyed by several of the men-of-war who have visited the island. The survey has been done from the coast. Since my return I have discovered the extraordinary coincidence that my father was Captain of a man-of-war which visited Espiritu Santo in 1896. Although he did not explore any unknown parts, yet he mentions in his diary two little lakes which have probably not been seen by a dozen whites other than himself and me. The older Admiralty charts make a mountain in the south-west of

[1] This name, spelled Aoba on Admiralty charts and Oba in the P.C.G.N. list, is pronounced Omba by the majority of the natives.

Garuga sp., the only regularly deciduous tree in the New Hebrides

Mount Tabwemasana from the north-west

from the west

the island the largest, and they label it Santo Peak to confirm this impression. It is known as Santo Peak or Pic Santo or (in Pidgin English) Big Santo to all the white inhabitants of the New Hebrides. When there are no clouds on it, it is easily seen from the Mission Station on Tangoa Island, where the steamship from Sydney calls, and from here it appears much the largest mountain.

In 1901 Mr. Higginson made an expedition into the interior of Espiritu Santo, but it is clear that he kept well to the east of the high mountains. Later, both Mr. (later Sir Douglas) Mawson and Dr. Speiser made separate attempts to climb the highest mountain in the New Hebrides by climbing Santo Peak. Neither got to the summit, though Dr. Speiser ascended a lower peak of the same mountain. In 1910–11 Messieurs les Capitaines Montègu and Renault carried out their Mission de Délimitation by crossing the island in several directions and carrying out a survey. Their results are embodied in a large map, which is supposed to be secret but of which Mr. Bird and I have had the opportunity of studying a copy. The map is an exact representation of their routes, but very little is marked off the route, and there is no sign of the two biggest mountains in the island. The dense cloud which nearly always caps them is certainly the reason for this. In 1912 the acting Resident Commissioner (Mr. Mahaffey), Mr. J. E. Fysh, and Mr. T. R. ff. Salisbury traversed the island from north to south, but passed a long way east of the large mountains. The map of the French Ministère des Colonies was evidently produced by putting together the maps of the Mission de Délimitation and the British Admiralty Chart.

Previously to my visit to the New Hebrides in 1927 I had noticed in the newer Admiralty charts a mountain to the north of Santo Peak marked 6169 feet. Santo Peak is marked 5520 feet. This mountain had been ignored by the whites of the islands, who persisted in regarding Santo Peak as the highest mountain. I was therefore sceptical of the real existence of this higher mountain to the north, but in company with Mr. T. O. Thomas and Mr. J. de H. Morel I explored the region and found the mountain fairly close to its position in the Admiralty chart. We climbed the lower peak of it. We were prevented from climbing the higher peak by the refusal of the natives who had accompanied us from the coast to remain long enough in the neighbourhood to enable us to find a way of achieving the more difficult ascent of the higher peak. The latter had never been climbed by natives, and was said to be impossible. We found that the name of this mountain is Tabwemasana.

We now come to the exploration carried out by the Oxford University Expedition of 1933–34. I was determined not to have to rely upon natives more than was absolutely necessary, and we therefore made plans to do something which has never to my knowledge been done before by other explorers of the interior of the islands of the New Hebrides. We planned to camp by ourselves in the mountains and to carry out our survey work independently of native help. It will be remembered that the French expedition failed even to see the big mountains on account of their being nearly always in cloud. This made a fairly extended stay in the mountains obviously necessary if anything approaching an accurate survey were to be made.

In the 1927 expedition we had ascended to the mountain from the west

coast, but on this occasion I decided to make the much longer ascent from the north. There are no harbours on the west coast, and it would not have been possible to get any one to remain with a boat waiting there for us for a period of weeks. We had no idea how long we should have to stay. If we could ascend from the north we could always get back to our base camp at Hog Harbour by the same route. To find out whether it was possible to reach the mountain from the north, Mr. Bird and I made a quick expedition within a fortnight of arriving in the New Hebrides. Our purpose was not only to find a route, but also to make friends with the natives and clear a camping site. We took only four carriers and took not an ounce of unnecessary material. Our route was up the river bed of the Hapuna, which was very fast flowing and which we had to cross no fewer than sixteen times on the first day. It was at our first night's camp that we met our dear friend Taw-waw-liwo for the first time, and he accompanied us throughout and also on the main expedition later on. Each day we walked as far as we could, both Bird and I carrying heavy loads. We were more exhausted each night on this quick dash than at any other time during the expedition, and we suffered very greatly by being kept awake nearly all night long each night despite our great exhaustion by innumerable fleas. On our return to Hog Harbour it was estimated that I had a thousand fleabites on my body. We succeeded in finding a route to the mountain. We found the deserted village where I had camped six years before, cleared a camping site among the dense vegetation which had grown up all over it, and returned to the north coast once more five days after leaving it. The camping site was the deserted village of Tatarii at 3960 feet.

The only white inhabitant of the north coast is Mr. W. Robertson, and his help to our expedition cannot be exaggerated. Indeed, I do not think that we should have been able to achieve our object if there had been an unfriendly planter in his place. He not only helped in securing coastal natives to act as porters, but also made his house a very pleasant place from which to work on all our various expeditions. We were always assured of a very warm welcome on our return from the wilds. On our return to the Mission Station at Hog Harbour, the missionary preached from the very apposite text, "I go to prepare a place for you."

The main expedition was a very different affair from Bird's and my rapid reconnaissance. We had one great set-back at the beginning. Harrisson was unable to come. For some weeks he had lain in bed with a very nasty sore in his leg with fly-maggots in it. We feared that the rivers were rising, and could not wait for his recovery. The exploring party was therefore Bird, my wife, and myself. This time we had a great deal of baggage. Our idea was to take as much food as we could to Tatarii, to be left there to stay until the survey was complete or the food consumed, whichever happened first. My sister remained at Hog Harbour, not only to do the meteorological work in connection with the study of breeding seasons, but also to make repeated daily observations of barometer and thermometer in order to enable us to fix our heights and particularly the height of Mount Tabwemasana. We left Robertson's on October 25 with forty-one native carriers. For some reason which I have never been able to comprehend, the people of the mountains would provide us with very little food for our carriers, although they

had plenty. Obviously we could not let them consume the food which was to support us three during our proposed stay in the mountains. Luckily I was able to persuade some of our carriers to start back towards the coast each day. This was possible, as naturally our stock of food was being reduced each day, and there was less to carry. We camped three nights before reaching Tatarii. Our route had once more been up the magnificent valley of the Hapuna, which runs between great limestone cliffs covered with luxuriant vegetation. Now that it is all over, it is clear that the getting of all our material to Tatarii was a more difficult task than the actual climbing of the mountain. Taw-waw-liwo and many other bushmen joined us on our way, and we were glad to have them, as other bushmen did not refuse them food. Fearing that we might never be able to find our way without native help back from Tatarii to the highest inhabited village (Nokowula), we marked our route with a multitude of flags, which had been specially prepared for this purpose before we left England. We also daubed tree trunks and rocks with white paint specially carried with us for the same purpose. This gave us a great sense of security when we were left alone.

On arrival at Tatarii we made the best possible use of the natives who were with us before sending them away. Bird took a party to begin to clear a track up Tabwemasana itself. Taw-waw-liwo took another to begin to clear a track to the open grass-land that was to form the base-line of our plane-table survey. Those natives who were left set to work to enlarge our little clearing, and to get water in canvas buckets from a ravine a few hundred feet below. I had blown the shell to recall every one from their labours, when to my amazement a white man limped into our little clearing. Harrisson had risen from his bed despite his sore being unhealed, had got a planter to take him round to the west coast in a motor boat, and had ascended close on 4000 feet so as to be with us on our attempt on the summit. When we actually climbed it he had only risen from his bed eight days before, having previously been on his back for five weeks. Despite this, he took the major part in clearing our route to the summit with an incredibly blunt knife which he had brought back from Borneo. When the time came for the natives to go back and leave us, the nineteen who had come the whole way from Hog Harbour absolutely refused to go back to the coast without first climbing Tabwemasana. There was no room for them to stay in our minute mountain tents at Tatarii, nor could we spare them any of our precious food, but they went back to Nokowula with instructions to wait for a day, and to come back again to Tatarii very early on the morning of the day following. We all needed that day's rest.

The actual ascent is best described from my diary, which was written on the spot.

"Monday, 30 October 1933. The day! Sedhi and other carriers arrived at Tatarii at 7.30 a.m. Bird and Harrisson went off at once to meet the main body of carriers at the Hapuna–Pualapa Pass and continued cutting Bird's path to the summit. My wife and I remained behind until all the carriers who were bringing stores from Nokowula arrived. We then went off after Bird and Harrisson, leaving Tatarii at 8 a.m. At a difficult place on the ridge many of the Hog Harbour boys were afraid and refused to go further. Others reached the top of the lower peak, Tauku, and then stopped. We found the

two bottles we had left six years ago looking exactly as though they had only just been placed there, with perfectly legible writing within. Harrisson went on ahead at once to cut a way to the higher peak, Levini, accompanied by Ragh and Bedhel and two West Santo boys. Meanwhile we swung the thermometer and read the barometers. Following in Harrisson's footsteps we found a vertical descent which looked impossible to descend without a rope. Harrisson had managed it somehow. We attached the rope to a tree and descended without difficulty. I was ahead. On the knife-edge ridge between Tauku and Levini I took barometer and odometer readings and shouted them to Bird, who was behind and who was doing the recording. It was impossible to see him through the thick vegetation. Getting no answer, I shouted again and yet again, a trifle impatiently, as I was anxious to get on to the summit. At last Bird replied, very politely, 'I am not in a position to record your reading.' Afterwards I learnt what his position actually was at that moment. He had given careful instructions that the man behind him should loosen the rope and then descend if he could. The man took him at his word and proceeded without delay to loosen the rope while Bird was still descending it. Luckily it was looped once round another tree. Otherwise he would probably have fallen down a precipitous slope into the Hapuna valley, some thousands of feet below. Harrisson worked wonders with his Borneo knife and hacked his way to what appeared to be the summit of Levini. Further hacking revealed a very slight descent and then an ascent to higher ground. This seemed to be without doubt the summit, but Bird cut a path down the slope on the other side until he had made certain that we had ascended the summit. We had reached the summit at 11.30 a.m. and heavy rain started almost at once, preventing us from taking any sights. We were all extremely cold. We took barometer and thermometer readings at once, to coincide exactly in time with my sister's readings at Hog Harbour. R.G.S. barometer 24·04 inches; J.R.B. barometer 24·08 inches; temperature 17·0° C.

"The heavy rain made the collection of insects very difficult, but my wife got quite a good collection of plants in flower, including several species of Orchids which we had not got before. I cut the top off a small tree and stuck on the stump of it a large metal cylinder which we had brought up for the purpose. Three paces to the east of it we half buried a bottle containing a statement that we had ascended the mountain, with a list of our carriers and ourselves. The following Hog Harbour boys came to the summit: Sedhi, Jimmy, Ngisa, Bedhel, Yako, Ura, and Ragh. Ura is the hideous little chap who was said to be so weak that it was useless to bring him on the expedition. Seventeen West Santo natives also ascended, including our dear old friend Taw-waw-liwo. The total number of people at the summit was twenty-eight.

"The summit of Levini is flat, and it is quite impossible to say that one definite point is the highest; therefore when the tree trunk rots away, and our metal cylinder falls into the tangle of screw-pine stems below, our ascent will no longer be marked. In a few months our bottle will be buried many feet in the tangle. It is unfortunate that the summit is not easily marked like that of Tauku. No one who climbs Tauku can fail to find our two bottles.

"On our return the rope was not used. We all managed—I shall never know how—to climb the almost vertical cliff up to Tauku without it, by hanging

on to roots. At the summit of Tauku, Bird and I drank the contents of one of the bottles, which we had purposely left there six years before. Harrisson and my wife went ahead on the descent from Tauku, while Bird and I surveyed the route. On our return we sent the carriers straight back from the Hapuna-Pualapa pass, and loaded ourselves with the rope, plane-table, water-bottles, etc. We arrived home at the camp absolutely soaked about 3.40 (it had rained continuously from 11.30 a.m.), with our clothes torn and our arms and hands scratched, absolutely filthy with mud from head to foot, and tired but very happy. We had tinned steak and tinned plum pudding and whisky for supper, to commemorate the event, and all felt at peace with the world. In reminiscence, our acquaintances were distinguished only by their virtues.

"The heavy rain had soaked our tent. The ditch had flooded and our mats, sleeping-bags and sleeping clothes were all wet. My wife got all her plants pressed and her insects into envelopes before we went to bed, and also managed to dry our bedclothes a little."

We now settled down to the routine work of the mountain expedition. Harrisson made a study of the birds of the region and a considerable collection of their skins, which promises to be of great interest. My wife made a collection of the plants and invertebrates and took photographs. Bird and I carried out the plane-table survey. We were very much handicapped by the torrential rain and by the covering of clouds which obscured the peaks except very early in the morning and after sunset. We tried surveying by moonlight, only to find that the peaks were easily visible but the thread of the alidade invisible. It was necessary to rise well before dawn and hurry to the point from which observations were to be made, but often we only had a few minutes after arrival there before everything was obscured. We were determined to remain until our food gave out rather than fail to make a reasonably good map. If later any large inaccuracies are found in it, they must be attributed to the extremely difficult conditions under which we worked; but we are confident that we have shown the main features of the valleys and watersheds. The most accurate things on the map are the elevations of places on our route. They were obtained from readings of two tested barometers and a tested thermometer on the spot, and the reading of a tested barometer and a tested thermometer at Hog Harbour at the same time. For measuring distances we used a special light odometer designed by my brother. This instrument caused much interest in villages in which a wheel had not been seen before. Once, after retiring to bed, I heard its familiar squeak far into the night. Next morning on starting the survey again I found that the cyclometer on it read nearly 5 miles more than my last entry of the night before.

It is difficult to convey adequately the extraordinary dampness to which we were subjected during our stay in the vicinity of Tabwemasana. It will give some idea if I say that on our return we all found Hog Harbour, with its 120 inches a year, really quite dry in comparison. We were never dry for one moment, day or night. I found that my dreams and day-dreams centred round an enormous perfectly white Turkish towel. The absolute filthiness of everything engendered dreams of white-tiled bathrooms among the others. We explored in various directions and I descended to the west to survey the

coast-line. When our food began to run short the survey was complete. We wished to attract the attention of the people in the highest village in the Hapuna valley, so one night after dark we ascended to the pass into that valley and fired off a number of Verey lights to the accompaniment of as much yelling as our lungs could produce. We listened in vain for any answering sound, and returned to our camp without much confidence of having attracted the attention of the natives. We were therefore very much relieved when next morning a party of them appeared at our camp.

The return to the coast was made very difficult by the heavy rain, which had swollen the Hapuna into a rushing torrent. Each of the innumerable fordings was an adventure. Without the rope it would not have been possible to get back to the coast. At each crossing one of us took one end of the rope and got across somehow, the other end being firmly held some way upstream. The rope was now held taut across the river and the remaining members of the party came across one by one holding on to the rope with all their strength. My wife and some of our smaller carriers were in continual danger of being swept away and dashed against rocks. Needless to say, everything in our possession was soaked. It was therefore very fortunate that Harrisson stayed a little longer in the mountains and came back by a different route: for if he had come with us all his skins would have been ruined. We finally reached the coast at Mr. Robertson's plantation three weeks after we had left it. It was very amusing to be present when our wild men of the mountains saw cows and a horse for the first time. One of them stood directly behind the horse, touching it, in order to measure it against himself. With the pig and dog, the largest animals he knew, that end was safe.

Comparison of our barometer and thermometer readings with my sister's made at Hog Harbour at the same moment gave the height of Mount Tabwemasana as 6195 feet. There is no doubt that Tabwemasana is the highest mountain in the New Hebrides.

All of us went on sub-expeditions in addition to the one that has just been described. My sister explored some unknown parts south of the north-east peninsula, thereby not only adding to her botanical collections but also obtaining material for the census of the island in which we all collaborated.

Harrisson and my wife made an expedition to the island of Gaua to the north of Espiritu Santo, in the Banks Group. They gave us January 10 as the very last day for their return, after which we were to do everything in our power to rescue them. There is no white man on the island, but they were relying on a non-existent motor boat which they thought there was on one of the other Banks Islands. When January 10 came and night fell and they had not returned, we were very anxious at Hog Harbour, and the anxiety grew day by day. In a few days I had covered 100 miles of walking to try to find a planter who would lend me his boat to go to the rescue, but no one would allow his boat to put to sea, as the hurricane season had now set in. To add to our fears the tail end of a hurricane hit us, sending the barometer down to a figure which we had never previously experienced. I walked halfway across the island to try to get to my good friend Mr. Robertson, who would be sure to help us if he could; but on arrival at the River Yora we found it swollen to a torrent which I can only compare to the Danube in flood, and no one could

have lived in it. (I have often swum across it when not in flood.) It was a swirling mass of uprooted trees; and as far as one could see, Big Bay was dotted with those which had already been carried down. The whole coast was littered with uprooted trees. There was nothing for it but a mournful return to Hog Harbour. By this time it really appeared probable that Harrisson and my wife had attempted to cross the 60 miles of open Pacific in an unsuitable boat and had been caught by the hurricane.

The little inter-island steamship was due in Hog Harbour, but did not come when she was expected. We discovered afterwards that she was delayed by sheltering from the hurricane. At last, on January 29, she arrived late at night. I went on board at once and begged the captain to take me to Gaua to search for Harrisson and my wife. He agreed. We were about to start when he insisted that he could see a light far out to sea to the north. Neither the other officers nor I could see anything, and we disbelieved him; but gradually a flicker became visible, and then it was clearly a light gleaming through the pouring rain. Great excitement prevailed when we began to be able to hear the chug-chug of a motor boat. In a few minutes she was alongside. My good friend, Mr. Oliver Stevens, who has a lofty disregard for hurricane seasons, had gone to Gaua to get Trochus shell and had brought them back. They had not wasted their six weeks upon the island, and indeed, before we went to bed we had almost forgiven them for nineteen days of acute suspense. They had climbed for the first time the steaming hill, Mount Gharat, and explored both the areas of boiling springs, had made a complete census of the island, discovered one of the few stone statues known in the group, and made a collection of the birds of the large lake which my wife, Morel, and I had explored and mapped six years before.

The object of Bird's expedition was to discover the course of the river Tawoli. He could not have had more difficult conditions under which to work. Not only was he suffering at the time from repeated attacks of malaria, but also during the time he was away the rainfall was at its heaviest. Further, there were neither paths nor villages when he got a few miles inland, and every foot had to be cut through the forest with knives. He succeeded in reaching a magnificent viewpoint on the Tawoli–Hapuna watershed (marked *x* on the upper panorama), and thus enabled us to extend our map considerably to the north-west.

The object of my own expedition was to discover the source of the largest river in the New Hebrides, the Yora. It was a race against time, because I was delayed by the late return of my wife and Harrisson. Unlike Bird, I had everything in my favour. All my walking to try to get a boat to go to Gaua had made me absolutely fit. I had splendid weather with very little rain, and there was now not much water in the river. Further, I had both Taw-waw-liwo and Karai with me as well as the faithful Jimmy, Wo, and Ura, who had been on the Tabwemasana expedition. One night we arrived at a village and saw a man the muscles of whose legs had almost disappeared, leaving only skin and bone. He walked on his hands, a half coconut shell being held in each to serve as a shoe. This affliction and many others were attributed to the evil machinations of a woman of a neighbouring village. Next day we went there, and I was confronted by her. A most extraordinary request was made to me

Crossing the River Hapuna

Mountain camp at Tatarii

Rafts made of banana stems on Steaming Hill Lake, Gaua Island

Stone statue on Gaua Island

Sakau women

Mountain chief at Nokowula

by Karai. I was asked to gaze at her through my instruments, and then to report whether in fact she was the cause of all the illness and death that was attributed to her. Her life was in serious danger, so I agreed, and made a most meticulous examination of her through my clinometer and prismatic compass. After serious thought I was able to report that she was guiltless. I felt that I had done my good turn for the day.

As we gradually got towards the source of the river it became apparent that it rose on Santo Peak itself, and I therefore killed two birds with one stone by climbing Santo Peak and walking in a circle right round the source. The ascent presented no difficulty whatever, as there is actually a native path running over it. The height is 5566 feet. The name of the actual summit is Mataniaro, but the name of the mountain as a whole is Lai-iri-iri. (It is worth remarking that the natives themselves do not regard Mataniaro as the highest point, but it was obvious that their summit, which I also climbed, is lower. This I confirmed by clinometer, and also by barometer readings at both points.) The name Losubunu has previously been used by whites as the native name for Santo Peak, but this is incorrect; Losubunu is a small peak on the south side of Lai-iri-iri. I reached the summit on the fourth day after leaving Robertson's and was back at Robertson's again four days later, having found many very strange customs among these isolated mountain people, about which there is no space to speak here. From the ridge between Mount Paramua-wawke and Lai-iri-iri there is one of the most magnificent views I have ever seen. Both to the north and to the south, Espiritu Santo is spread out like a map. By merely turning one's head one sees Big Bay in one direction and the south coast with the off-lying islands of Auri,[1] Malo, Tangoa, and Araki in the other. The large island of Malekula appears in the distance. The foreground is a mass of mountains in every direction.

The part of our map on which least reliance is to be placed is a relatively small area lying between the plane-table survey of the main mountain expedition and my prismatic compass survey on this expedition; that is to say, the region of the River Metanoiai (a tributary of the Yora). Of the two panoramas, the upper is a sketch made rapidly from a moving boat, while the lower is an accurate representation of the mountains made at leisure. It is perhaps worth mentioning that we were particularly careful about the spelling of the names, following the local native pronunciation as closely as possible according to the R.G.S. II System.

We found Mount Tabwemasana to be 6195 feet high and to lie about 7 miles in a direct line from the nearest point on the west coast, and about twice as far from the nearest point on the shore line of Big Bay. From it there radiate four main ranges of mountains, which run roughly north, south, east, and west. The River Hapuna rises between the north and east range, and a tributary to the Yora (probably the largest river in the New Hebrides) rises between the east and south range. These two rivers reach the sea at Big Bay. The River Vakola runs between the south and west ranges, and the River Pualapa between the west and north ranges. These two rivers reach the sea on the west coast. The main stream of the River Yora rises on Mount Lai-iri-iri (Santo

[1] The native pronunciation of this name, spelled Aore on Admiralty Charts and by the P.C.G.N., is more properly represented by Auri according to the R.G.S. II System.

Mountain chief at Nokuvula

Sakau women

Stone statue on Gaua Island

Peak), which is also the source of the river reaching the sea at Keriwai on the west coast, and of the River Navaka reaching the south coast at Tasmalum (or Tasmalun).

In the whole of the mountainous region there is very little land which is sufficiently flat for cultivation or for the situation of villages. The only considerable area of fairly level ground is an area of perhaps half a square mile between Sulemolimoli and Lavabavanakoi, near the source of the River Yora. The mountains run straight into the sea down most of the west coast, except just to the south of Wus, where there is a little cape of low ground. There is a tendency for the mountains and ridges to be steepest near their summits and crests. It is a country of very sharp ridges radiating from mountains. In the mountainous region the slopes into the valleys often become steeper as one descends to the river beds, possibly an indication of a second elevation subsequent to the main one.

The high mountains in the region which we explored are composed of basic volcanic rocks (andesite and basalt). The summit of the higher peak of Mount Tabwemasana is composed of andesite tuff with lapilli. The region of the little village of Mataitalao, on the Yora–Lambe watershed, is composed of very pale grey hornblende-andesite rock, contrasting markedly with the dark rocks occurring nearly everywhere else in the high mountains. A little stream flowing into the River Yora near Lavabavanakoi contains large lumps of magnetite, whose high specific gravity has attracted the attention of the natives, though they are entirely ignorant of the smelting of metals from their ores. On the west coast the basic volcanic rocks descend to the sea. Near the outflow of the River Pului there is a deposit of a red ceramic, the source of the well-known Wus pots, almost the only earthenware made by the natives of the New Hebrides. At Betap, in the bed of the River Naivela, near its source, there is a mass of a rock which at once attracts attention on account of its whiteness. This is a limestone, whose occurrence at an elevation of about 3400 feet is most remarkable. It contains Foraminifera, and it is hoped that they may serve to date it.

The large area of land at elevations of less than 1000 feet through which the rivers Tawoli, Hapuna, Raghovi and Yora wind their way to the sea is a limestone, which also contains Foraminifera. The rivers, especially the Hapuna, run in places between magnificent vertical cliffs of this limestone, sometimes several hundred feet high. The strata are nearly horizontal, but tend to dip slightly to the north in the valleys of the Yora and Raghovi, and sometimes slightly to the north and sometimes slightly to the south in the valley of the Hapuna. (This area of sedimentary rocks is bounded to the east by the large area of raised coral, in several tiers, which forms the eastern peninsula and the country south of it.) The rivers are filled with rounded volcanic stones from the mountains, and the shore of Big Bay is formed of the black sand produced by their disintegration.

There is a general tendency for the weather in the high mountains to conform to the following routine (October and November): In the early morning visibility is good. About 10 a.m. clouds may be seen gathering below, and strong up-currents carry them rapidly upwards, blotting out vision in every direction. Heavy rainfall starts almost at once, and continues until nightfall,

when down-currents expose the mountain tops, and the nights are often starlit. The whole island is clothed with luxuriant forest vegetation except certain of the northern slopes of the mountains, which are grassy. The dominant tree above 4000 feet is *Metrosideros collina* (*Forst.*) *A. Gray*, whose red stamens make a brilliant show when one looks down on them from above (October and November). A magnificent tree of the high mountains is the kauri, *Agathis obtusa* (*Lindl.*) *Masters*. Orchids, both epithytic and terrestrial, are abundant at high elevations, and a few were sent home and arrived alive at Kew. The staple food of the natives of the mountains is taro, but they grow coconuts up to nearly 1400 feet in one place. There are plenty of excellent oranges in the valley of the River Yora up to 1000 feet or more. Along the banks of the rivers in the limestone district the dominant plant is a species of Equisetum, which grows in extraordinary profusion: Casuarina trees are here fairly abundant, and one occasionally sees an Acacia. Casuarina and Acacia do not occur elsewhere inland.

It is perhaps worth mentioning that the expedition climbed the following mountains, none of which had been climbed by whites before (though the French Mission de Délimitation had approached near to the summit of Linisupe): Tabwemasana (Levini), 6195 feet; Lai-iri-iri (Santo Peak), 5566 feet; Linisupe, 5369 feet; Paramua-wawke, 4197 feet; Ratsawoni, 4328 feet; Wunarosaisari, 4125 feet; and Wuna-tupoi, 3918 feet. When four of us left the islands to return to England, Marshall joined the expedition and Harrisson stayed on with him to complete the year's work on meteorology and breeding seasons. Together and separately they seem to have covered every part of the island which had not previously been explored. They became involved in two native wars. Harrisson climbed the highest mountain in the north-west peninsula.

I wish to thank the following firms whose gifts of stores did so much towards making the expedition possible: Imperial Chemical Industries, Ltd., Messrs. McVitie and Price, Messrs. Frank Cooper (Oxford), Messrs. John Jameson, Messrs. Cadbury, Messrs. Crosse and Blackwell, and Messrs. Brooke Bond and Co. Among the many who helped us in the islands we must especially mention the British and French Resident Commissioners, Mr. Robertson, Mrs. Lingham, Mr. T. R. ff. Salisbury, the Rev. W. Anderson, Mr. Dupertuis, and Père Ardouin. Messrs. Burns Philp most kindly twice sent their steamship *Morinda* to Hog Harbour for our benefit. We wish to express our gratitude to this Society for invaluable moral and practical support.

APPENDIX I: THE EXPLORATION OF THE TAWOLI RIVER: JANUARY 1934

T. F. Bird

The exploration of the Tawoli river was undertaken in order to link up this area with Dr. Baker's more extensive exploration of the Upper Yora valley, and the main survey carried out by Dr. Baker and myself.

The technique of travelling which had to be adopted on this survey differed from that employed on the other surveys made by the expedition. While on previous trips it had always been possible to spend the night in the shelter of a native village and obtain some local food, the Tawoli valley is uninhabited, and

except for one deserted village occasionally used by hunting parties from the Yora, there are no native houses or gardens. This increased the difficulty of the survey and necessitated heavy loads being carried and shelters being constructed at the end of each day's journey. Most of the other trips made by the expedition were along river beds or followed native tracks. Owing to the exceptionally heavy rainfall it was impossible to travel along the bed of the Tawoli, and every yard of path had to be cut through thick vegetation. This, coupled with the fact that for the first five days of the journey it rained almost without cessation, made progress difficult, and the original party of natives from Big Bay probably would have turned back if we had not been fortunate enough to meet some bushmen from the Yora valley. Four of them, led by Karai of Wunapakatamante, joined our party. They gave great assistance, and Karai, who subsequently met Dr. Baker on the Yora, was probably one of the most remarkable natives we encountered in the New Hebrides. Weighing only about 8 stone, he possessed a tremendous store of vitality and energy, and was a fearless climber.

Our journey started from Big Bay. We were assisted, as before, by the planter William Robertson, who did everything in his power to help us. As I was accompanied by only two natives from Hog Harbour, we spent a day collecting a guide and some carriers. We were fortunate in getting an aged mission boy called Amos to act as a guide. He had lived formerly at Tapapa and consequently knew the names and position of some of the villages which had existed in this valley. Our equipment consisted chiefly of food, and in order to cut down weight no cooking stove was taken, and our rations consisted mainly of ship's biscuits and rice carried in double canvas knapsacks. It was arranged that our first day's journey should be from Big Bay to Tapapa, which we reached late in the afternoon, and after having some difficulty in fording the rising river, we found that the few broken-down huts from which we expected to get shelter were occupied by the bushmen already referred to. In driving rain we set about making a shelter and barely succeeded in completing it before nightfall. This was repeated at every halt for rest, except on two occasions when the route was particularly difficult; then the party split up and one group went ahead with knives to cut a road and make a shelter while the rest followed later with double loads. In spite of the fact that the natives live in a climate of high rainfall they showed a marked disinclination to go out and start cutting a path in the rain. Consequently it was often two hours after sunrise before we could get started on the day's march. The fine spell usually lasted about ten minutes, and then it started to rain again.

After leaving Tapapa we made a series of camps. At Camp II we struck the river, but found it was in a narrow canyon. Owing to the continuous rain it was rising rapidly and the noise was terrific. Speech was impossible and one could only hear the ticking of a watch when it was pressed against the ear. Camp III provided a good view of the surrounding country and enabled back bearings to be taken on Big Bay and the mouth of the Tawoli. Camp IV was our final stopping place, and we were compelled to halt here in order to fix our position when the visibility permitted. Food was now scarce, and above Tapapa we had found no deserted gardens with taros or bananas. Matters were complicated by the fact that one of the bushmen was a moli, or chief, who had to prepare his food on a separate fire. This taboo meant that we could not share our remaining tins of compressed meat. On one occasion in error I offered him some food which had been cooked on another fire. On learning of the mistake I hastened to inform him, whereupon he was immediately sick and complained of stomach pains for the rest of the journey.

When the end of our rations was reached there was no alternative but to send

back all the natives, who could get some food from the dumps left at each camp. Karai consented to stay on without food. But in spite of this shortage of food our time was limited because I had promised to send back the survey instruments to Big Bay by the 23rd to enable Dr. Baker to commence his exploration of the Yora. Fortunately on the last day the sun came out and the excellent visibility enabled us to make a panorama of the Tabwemasana group and to see the source of the River Tawoli, which rises in the cup of a range of mountains which are part of the North Pualapa range.

The vegetation of the Upper Tawoli was similar in all respects to that of the Hapuna and Tawoli valley, but the general formation differed slightly from that of the Western valleys of Santo inasmuch as the characteristic effect of sharp peaks and sloping sides dropping into a deep canyon is not so marked. The guide Amos and the rest of the party confirmed that no previous expedition of white men had been up the river higher than Tapapa. The French Survey had visited Tapapa and camped there for two days while one of their party visited Powelimoli. They then crossed over into the Hapuna valley, spending one night between the rivers at a village called Aripuselevo. Dr. Speiser did not go higher than Tapapa, and he must have carried out some anthropological work there, for the natives vividly described how he measured heads. This appears to have made a lasting impression on all concerned. He examined a group of about ten pygmies at Tapapa all of whom belonged to one "line." Some pygmies also came down from a village called Unakaraw, but the natives were positive that Dr. Speiser did not visit the place. Contrary to local belief, there are now no pygmies left in the Tawoli valley.

Questioned on the causes of the depopulation of the lower portion of this valley the natives, and in particular Amos, confirmed that the inhabitants of Tapapa died of dysentery and from a complaint whose symptoms indicate that it was probably some form of venereal disease. It was probably contracted from contact with the coast people, as many of the natives used to work on the plantation of Mr. Fysh at Big Bay. The period of this depopulation is difficult to fix, but when the French visited Tapapa twenty-three years ago it was a flourishing village; now it is completely deserted and its few descendants live at Big Bay.

On our journey up the valley we saw no birds or mammals, but a few birds were seen at Camp IV during the brief period of sunshine. It should be noted that the mouth of the River Tawoli is liable to change from season to season. I am grateful to Dr. J. R. Baker for the advice he gave when the project was first discussed, and also to Mr. S. J. Baker without whose help it would have been impossible to add this survey to the main map prepared by members of the expedition.

APPENDIX II: THE BIRDS OF ESPIRITU SANTO

T. H. Harrisson

Towards the end of last century several famous naturalists visited the New Hebrides. From that time until recently knowledge of the island birds has not advanced. The activities of the Whitney South Sea Expedition, 1920–1933, have cleared up many taxonomic problems. The reports on their collections, by Dr. E. Mayr and others, are appearing in *American Museum Novitates;* it should now be possible for ornithologists anywhere in the Southern Pacific to go direct to biological and general problems, without the necessity for collections and systematic investigation, except in the untouched mountain areas.

There are about fifty species in the northern part of the group confined to four habitats: (1) the low dense jungle, almost all of which has been felled or

cleared in the past, when the islands were densely populated; (2) cane grass, confined to a few areas; (3) native gardens; (4) coconut plantations. The last two are historically recent habitats, and the birds frequenting them are often apparently of recent origin in the area. There are five lakes in the area, small mangrove patches, and a different vegetation at high altitudes. Taking samples of all species (2000 birds examined) and special studies of certain common ones (Zosterops, Turdus, Myzomela, Collocalia), I found a marked preponderance of male birds in nearly all cases. Examination of embryos, nestlings, and immature birds has shown different ratios at different ages. At high altitudes and on very small islands the ratio also differs from that at sea-level on large islands. The study of this problem, with as many localities and species as possible, has been my first interest here. At the same time in the same localities I have studied human sex ratios. In connection with this work I have weighed and measured eggs, sexed and weighed the contained embryos, recorded weight, size, and food habits at all ages. Incidentally the size, structure, carrying power, and variation of nests has been observed.

My second interest has been in the biology and taxonomy of moult, concerning which knowledge is scanty and superficial. Certainly moult here differs from anything previously recorded; it also shows marked seasonal rhythms, but these do not correspond even in two species of the same genus. At high altitudes there are further differences. In order that the study may cover every month in the year my friend A. J. Marshall is carrying on with it after I leave. We hope to correlate moult with weight, gonad condition, and song, and to reveal the value of controlling factors, internal and environmental. Samples of selected species, studied simultaneously on prearranged dates by each of us working on widely separated islands, should enable us to determine the extent and constancy of these influences.

The third objective has been a study of food: food in relation to habitat, seasonal variation, amount of food required, feeding hours and activity (in different kinds of weather), differences between food of adults and young (sometimes remarkable), weight of stomach contents in relation to weight of bird—especially animal as compared with vegetable feeders. Food data have been correlated with census. Census work has been carried out in all habitats and altitudes (0–4000 feet). In the bush this has been difficult, and the method finally adopted has been repeated visits at different hours to a small area—usually one-fifth acre—surrounded by a narrow path cut for the purpose. Attention has been focussed on the historically recent man-made habitats, especially coconut plantations.

Altitude zonation was worked out on Mount Tabwemasana; I stayed in the mountains after the others had gone down in order to complete this, and was able to make comparative studies by average stops of a week at Wus and Lomparia (sea-level, West Santo), Nopu (2500 feet), Betap (3500 feet), and Tatarii area (4000 feet). In the upper zones I collected specimens for the British Museum. These include two probably new genera, a starling and a pigeon with terrestrial habits, and no doubt a number of new species or subspecies. I made many observations on *Ducula bakeri* and *Cichlornis whitneyi*, two species previously known only from the single type specimens. There were constant differences between breeding season, sex ratio, song, moult, and fertility at each of my four camps. These mountain data were particularly interesting to me in view of my recent work in the Mountains of Borneo. In December I was able to confirm the intermediate level zonations on Gaua in the Banks Group, where Mrs. Baker and I camped in the *Vuros* (hot-spring) area. I also observed the nest, eggs, young, and habits of the rare rail *Poliolimnas*.

Of special studies the chief has been on *Podiceps leucosternos*, a new form of grebe found on Dolphin Island by the Whitney Expedition. I spent one week and many odd days on the island, studying these birds, swimming in the two lakes to locate and watch nests; I also found them present on the Gaua lake. Detailed observations over short periods (average ten days) in different months have been made on the song-rhythms of Pachycephala, Gennone, and Cacomantis, and these have been correlated with climatic factors. Inter-island song variation has been noted. Marshall and myself are making an elaborate study of swift colonies (*Collocalia esculenta*), particularly with regard to incubation and fledgling periods, daily rhythm of activity, constant local nest variations, and daily change in weights of the young. In connection with the last point, several species have been studied, and found to show a curious nestling graph-curve in weight, the young at one period exceeding the adult. Many notes on the general economy, mortality, size of clutch, calls, and habits of all species have been made, particularly on Neolalage, a genus confined to the group.

About two hundred skins and spirit specimens have been collected for the British Museum. All those data which are solely of ornithological interest will be published in a monograph of the Northern New Hebrides, which will aim to give the maximum information on every aspect of the bird population within a limited area. In order to complete this, I hope to visit and stay on every island in the northern part of the group (including all the Banks Islands and the mountains of Omba and Maewo) before I leave. The general problems, as outlined above, will be dealt with separately. Marshall and myself have already prepared a paper comparing the economy of inter-related birds in the New Hebrides and Australia; the object of this is first to find whether birds show economic variations comparable to taxonomic variations, and thus whether subspecific systematics bears any relation to the life of the bird; second, to find and define the value of ingrained traditional species behaviour, and how far this can be changed by environment; third, an analysis of the factors influencing bird life in the islands differently from on the continent.

The ornithological results are satisfactory, if considered as a sideline of the main corporate activity of the expedition, *i.e.* the breeding season investigation.

APPENDIX III: NOTES ON THE SURVEY EQUIPMENT OF THE EXPEDITION

S. J. Baker, late R.E.

The problem was rather a difficult one: there was no trained surveyor accompanying the expedition, the country was for the most part heavily covered by forest, and I anticipated considerable local variation of the compass, as the rock of the largest mountain had been shown to be augite-andesite, of which one of the constituents is magnetite. Further, there is an extremely heavy rainfall, and the combination of heat and damp would discourage mental activity, so that calculations of any kind were to be avoided if possible. Also the previous expeditions had had great difficulty in procuring sufficient carriers, so the equipment had to be light and portable.

Fortunately it was known that the northern slopes of some of the mountains were grassy, unlike the rest of the island, and this suggested to me the use of the plane-table where possible. I had recently seen in the *R.E. Journal* an account of the use of aluminium sheets with the paper permanently attached to them, and I provided several sheets, papered on both sides, which withstood the dampness of the mountain expedition in a very remarkable manner. Unfor-

tunately I had only about a day and a half in which to instruct my brother and Bird in plane-tabling, so I had to confine instruction to the very elements of the art. The remainder of the area, that which proved unsuitable for plane-tabling, was to be mapped by compass traverse.

In order to avoid all possible confusion I equipped the expedition with only one set of scales, and that 1 inch to a mile, and I kept all distances in miles and decimals of a mile for the same reason. Heights were to be determined by aneroid, one aneroid being read every few hours at the base at sea-level during the whole period of the survey, and air temperature also being taken at the time of each barometer reading. I used a formula for correction for air temperature, but did not include the corrections for latitude, as being trivial. For points off the route vertical angles were taken by Abney clinometer, and I devised a small slide-rule to read differences of height directly from the angles observed and the distances in miles. I did not mention the corrections for refraction and curvature, as for a rough survey of this nature they are unimportant for rays of under 10 miles in length, and these were not likely to be exceeded.

So that none of the numerous articles required for plane-table survey might be forgotten, I made a holdall, in the form of a waterproof canvas breastplate, with a fitted pocket for each separate item, so that one could see at a glance whether all the pockets were filled. This worked well in this country and in practice at the expedition's base, but unfortunately the extreme damp of the mountains shrunk the canvas to such an extent that a knife had to be used to extract the implements from their pockets. The idea is however I believe a good one, particularly for hot climates where one's exiguous garments do not provide the wealth of pockets available in more conventional attire. Inks, pens, etc., required in camp, but not in the field, were packed together in a little box under 7 inches long and 2½ inches deep.

As the country was so difficult that extension of the base from a short base measured in the usual manner might prove difficult, I advised the use of a long base (one of over 3 miles was actually used) measured by a simple odometer which was also used for the compass traverses until it ultimately gave out. It is not difficult to construct a reasonably accurate odometer reading to hundredths of a mile from a cyclometer and a perambulator wheel, but it is difficult to construct one which will stand up to the rough treatment of an exploratory expedition. The ordinary striker mechanism is hopeless, as creepers get caught up in it. I used a direct drive, but it gave trouble. The ideal would be a flexible drive with the cyclometer fitted on the handle where it would be convenient to read, but it is not easy to design one which will resist the combination of rough handling, wet, mud, sand, and tangling creepers and grasses. It will be noticed that I made no provision for fixing absolute position. For a comparatively small island, and with no trained surveyor, I considered it both unnecessary and impracticable.

The final map produced by the expedition is a combination of plane-table sketch, compass and odometer traverse, compass and time traverse, and compass intersections. Of its accuracy I would only say that it is within the accuracy of the Admiralty chart within which it is plotted. That is not, I am afraid, saying very much. There is a difference of 3½ miles between the Admiralty Chart and the French Survey in the distance of under 30 miles between the north and south coasts.

The plane-table sheets were prepared as follows: The aluminium sheets (thickness 0·04 inch) were first cut accurately to the size of the plane-table top. The corners were then rounded and all the edges carefully smoothed and rounded. Next a "grain" was put on the sheets by going over them carefully

with a wire scratch brush in the chuck of an electric drill. This left a surprisingly regular granular "tooth" for the adhesive. Both sides were similarly treated. Then the paper was cut to a little over the size of the sheets, and the surface of the sheet and the under surface of the paper were both spread with "Rawlplug Durofix" (selected as being unaffected by heat and damp), and the two were placed in position together. The exposed face of the paper was then rapidly sponged over with water, and the paper was then stripped off again, and set aside (sticky side up) for about five minutes to expand. The aluminium sheet was then given a second coat of Rawlplug Durofix, and the paper was again applied, and carefully rubbed out from the centre with a clean rag, the edges being rubbed over the edges of the aluminium to about a right angle, and the surplus paper being removed by sandpapering through it against the edge of the aluminium sheet. Paper was applied to the other side of the sheet in the same way. The object of papering both sides of the aluminium was to economize in the weight of sheets to be carried, and to provide a second sheet available in the field if required. The aluminium sheets were attached to the board by strips of 2-inch surgical zinc oxide adhesive tape, so as completely to seal the edges.

APPENDIX IV: NOTE ON THE GEOLOGY

W. Campbell Smith

The geology of the south-western part of Espiritu Santo as far north as Wus has been described in some detail by Sir Douglas Mawson ("The Geology of the New Hebrides," *Proc. Linnean Soc. of N.S.W.*, 1905, vol. 30, pp. 400–484), who visited the island in 1903. The geological specimens collected by the Oxford University Expedition, nine in number, give some indications of the occurrence of the three main groups of rocks recorded by Mawson in an area just north of the region studied by him.

The specimen (No. 9) forming the coast north of Wus is a very dark green volcanic rock much broken up and traversed by thin white veins. It consists of fragments of a very dark andesite with an opaque dark brown glassy base and many phenocrysts of felspar and a few serpentinous pseudomorphs after olivine. The felspars are all entirely altered. This rock probably belongs to the "Earlier Volcanic Series," probably early Miocene in age, which Mawson found up to 400 feet above sea-level in the Puria Esta district and cropping out in the cliffs along the coast from Saurii to Cape Babana.

Limestones which may belong to Mawson's Miocene series were collected from the right bank of the River Hapuna about 1 mile below Luaimoli, at about 500 feet (1); the left bank of R. Yora, just above inflow of R. Aibusa, at about 614 feet (2); and at Betap, bed of R. Naiwela, at about 3400 feet above sea-level (8). The first two contain abundant small grains of volcanic material, but the third is extremely fine-grained and compact, and appears to be pure limestone. The specimen is only a small one and no fossils are visible. It occurs at a much greater elevation than seems to be indicated for the Miocene in Mawson's map.

The other rocks are olivine-bearing andesites, andesite-tuff, a hornblende-andesite (? dike), and olivine-basalt. They are similar in general character to the lavas of the recent volcanic series of which Mawson has given a full account. The lavas and tuffs are all three from heights of over 4500 feet above sea-level. Augite-andesite has already been recorded from the summit of Mount Tabwemasana (J. R. Baker, 'Man and Animals in the New Hebrides,' 1929, p. 189).

DISCUSSION

Before the paper the PRESIDENT (Major-General Sir PERCY COX) said: The New Hebrides, as you all know, is the name of a group of islands in the Pacific about 1500 miles to the east of Queensland, and Espiritu Santo is the largest of the group. Our lecturer was no stranger to that group before this expedition. He has been there twice before: in 1922–23 and again in 1927. After the latter expedition he read us a paper on both his expeditions in the New Hebrides. I cannot imagine any region in the world providing so much interest from so many points of view as the New Hebrides. Whether it be mammals, birds, aborigines, or climate—in every direction in which you look you find something of interest. I feel sure that after you have heard Dr. Baker's paper you will agree with me on that point.

Dr. Baker then read the paper printed above, and a discussion followed.

The PRESIDENT: You will have realized what an important part the ladies of the expedition played in this most interesting trip. I will ask Mrs. Baker to give us some of her impressions.

Mrs. BAKER: I suppose the great difference between a civilized community and a savage community is that whereas in a civilized community one tends to spend all one's time rushing about doing things, in the latter one is nearly all the time doing absolutely nothing. I found it very trying doing nothing and never got used to it. I was always waiting for things to happen and occasionally exciting things did happen; but most of the time was an alternation between days and days of nothing doing and then one day of tremendous excitement.

When I first arrived at the village of Sara I saw the women just sitting in the mud doing nothing, but on seeing me they snatched up their children and fled away into the bush, shrieking. They had never seen a white woman and they were absolutely terrified. When the women fled I wandered about the village and found the men's club-house, typical of Melanesia. About twenty big savages stalked out and stared at me, so I shook hands with tremendous friendliness, and they just went on staring. Then I gave them all sticks of tobacco and they pretended I had not given them anything, which is the correct behaviour on receiving a present in Sara. I indicated that I would like to stay in that village, and they seemed to think that was quite all right. Therefore I proceeded to make myself at home. Gradually the women came back and peeped at me. I saw they were interested in everything I did and astonished at some of the things I did. When I started eating, putting food into my mouth with implements, they were astounded. But washing really brought the house down: they themselves never wash. Later on I used to wish I had kept this washing business dark. The chief's wife got washing-conscious and wanted me to wash her very often. I think she thought it took years of practice to get good at washing. I used to wash her and found it most interesting because of the amount of mud there was on her. She really was not as black as she was painted. She looked very cross, but she was not; she was really very amiable. I used to sleep in her house when I first went to the village, but it was a very restless proceeding because she and all her orphan boys were very cold at night. They only wore a little tail of leaves, so they had a little fire by the bedside and all night long they were messing about with fires, trying to keep warm.

Later on, Nebv, the chief, made a lovely little house for me. I was a bit sad when I first saw it because I thought it might keep me away from the village, but it did not because the village came to me. All day and most of the night my little house was absolutely full of people. The housing conditions in Sara are very extraordinary. Every married woman has her own house and every married

man has his own house. In addition, he uses the club house which he belongs to, and does most of his cooking there. A married man must never, under any circumstances, go into his wife's house; but I did, very rarely, see a married woman stealing into her husband's house. It was in my house that I did most of the waiting. Occasionally somebody would come and tell me there was a big hunt on. The natives and I would go off all day long into the forest and come back carrying live wild pigs, struggling. Then there was the dance which was similar in every detail to the one I had attended six years before, and that was very interesting. You see on the screen two of my very good friends, Sagh and Hingi, roasting a pig at the end of the dance. Those two men were most marvellous drummers. Sometimes, during a rather boring day of just gossiping, they used to come and tell me that they were going out to play around in the forest. I would go with the men and boys. First of all they would start to climb trees and show off with their bows and arrows. Then they would clear the ground round and would tie me to the end of a great rope or liana hanging 60 feet from the tops of the trees and one would seize me and climb with me right the way up and, keeping the rope taut, let me go. It was the most wonderful swing, right up and right down. When they got tired of that Hingi and Sagh would start drumming, and all the others would start leaping and shouting, and when dusk came they took up their drums, and the drumming and shouting went on all the way back to my house.

The last time I went to Sara it was not quite so happy because war was threatened. Poor Nebv did not want to fight: he had already killed three men and wanted a quiet life for a bit. He was rather afraid people might kill him if he did not consent to the war. He always followed me about and would never leave me. He came down to our camp at the end of the time. Though he looks very ferocious he was very kind to me. He had an awful inferiority complex about his hair. He was always stroking mine and saying "*Vokovok*," which means "pretty decent." I used to tell him that I thought his hair was lovely; that he had no need to wear a hat ever. It was entirely due to him and his friendliness at first that the women gave me their confidence and I was later able to learn some things from them which may throw some light on their rapid and tragic depopulation.

I will now show a few slides and say a word or two about Gaua, where Harrisson and I were forced to stay six weeks. The map was made on my husband's survey expedition six years previously. You will see the mountain I had the mad ambition to climb. As soon as Tom Harrisson arrived on the island we marched straight up here to the Percy Sladen boiling springs, which we had discovered previously. There we made a camp, just a little tent and a banana-leaf shelter. All round was sizzling and boiling mud and steam, and the most terrible smell of sulphur. We used to do our cooking by putting our tins of food into the boiling mud round about us. On Christmas Day, of course, we put our Christmas pudding in there. All round us was a sort of devastated area, very hot and sulphurous, covered with the most wonderfully-coloured mud—red, blue, purple—and sulphur crystals and lots of iron. We were very thrilled with the geology and collected many specimens. We thought the British Museum would be as excited as we were, but they were not. They sent us back our mud but they kept our sulphur crystals. Why, I do not know.

When we told the natives we wanted to climb the mountain they were very much against it. They had never set foot on it and were very frightened of it. However they consented to take us to the foot of it. We managed to climb to the top. It was very hot. There were great banks of hot moss, and steam everywhere. We collected various specimens and came down from the mountain.

When we reached the coast we spent nearly all the time trying most extraordinary ways of getting back to Espiritu Santo, without success. We also spent a good deal of time making a complete census of the island. We could not go very far away from the coast for fear of missing a passing boat. On one of our expeditions we came upon a stone statue which, I believe, is of great rarity. It was a great relief when Mr. Oliver Stevens came and took us back to Hog Harbour in the boat. I think the rest of the expedition forgave us some of the anxiety we had caused when we were able to show them some of the work we had done.

The PRESIDENT: You will I have no doubt remember, in connection with previous lectures dealing with islands of the Pacific, especially the New Hebrides, that incidents in the naval career of Commodore James Goodenough, the father of my predecessor, Admiral Sir William Goodenough, were tragically associated with the islands of this group. I will ask Sir William to give us some reminiscences of his father's experiences in these waters.

Admiral Sir WILLIAM GOODENOUGH: Hardly, perhaps, reminiscences, Mr. President, but I thought it might be of interest to make some comparison between the very interesting visit paid by Dr. Baker and a visit paid now nearly sixty years ago when conditions were, even in these little-changing places, considerably different. What I refer to occurred to my father about a fortnight before he was mortally wounded.

He went, first, to the south part of the island, Cape Lisburn, down on the south-west coast, and there, he says, he found "the people small; the women quite tiny, with straightish features"—I read from his Diary—"small pointed chin and cheerful expressions." And it is of great interest to find how much the natives vary in different islands round about there—Espiritu Santo, Malekula, and the other islands of the New Hebrides. And not only how very much they differ but how enormously their language differs. I was told, I think by Dr. Ivens, that there were something like one thousand different dialects. It shows, I suppose, how very seldom the natives travel from one place to another. It would be interesting to know from Dr. Baker whether the communications there are between the islands make any difference in the change in language.

Those who are interested will find a description of nearly all these islands in the life of Commodore Goodenough (chapter 9 and Appendices), which is in the Society's Library. What is interesting and strange is the description of the formations of the islands, the coral formation in the north, and how the coral grows on the volcanic deposits, both the pebbles and great boulders. Though I have no intention whatever—for I know nothing about it myself—of going into the vexed question of coral and sinking islands, those interested will find a considerable amount of description there. One thing my father noticed—and I have referred to it before, after Miss Cheeseman's lecture. He says, "it is remarkable that just in proportion to the amount of people who have been taken away as labourers, so are the natives inclined to assault Europeans. Where white men are least known the people are most friendly." It is a great satisfaction to read now, in the latest edition of the Admiralty Sailing Directions, that owing to a better understanding between the natives and white men particularly, the people are much more friendly than they used to be. You heard Dr. Baker say how well he got on with the natives.

What is interesting and what I should like to hear some other time from Dr. Baker is about the ornamentation of the men's and women's dress. The men seem to dress themselves up more than the women. In one place my father says: "I saw two nose ornaments of quartz about one and a half inches or two inches long from the septum. The men's dress is almost elegant. Round the waist a strong piece of bark half an inch wide," and so on. In one place he men-

tions that he came across no sign of any gods or worship, or anything of that sort. Here again it would be interesting, from an anthropological point of view, to see whether they have now any form of worship, or even any animistic ideas.

I thank you very much, Mr. President, for the reference you have made.

The PRESIDENT: I think you will agree with me, ladies and gentlemen, that we have had a thoroughly enjoyable evening and Dr. Baker's lecture makes us realize what extraordinarily good and valuable work these modest expeditions organized by the University Exploring Societies are able to accomplish. As Dr. Baker told us, a special feature of his expedition was that ladies were for the first time included among the personnel, and as we have seen for ourselves they played a role of great value. In that connection I know I shall have you with me in thanking Mrs.Baker very warmly for the brief but very interesting details she gave us of her own particular experiences and for the charming way in which she told her tale. That she should have succeeded in gaining the confidence of the native women to the extent that she did shows how much, in a case like this, the possibilities of acquiring intimate knowledge of the habits of strange and interesting people may be increased by the presence of the feminine element among the expedition's personnel.

Dr. Baker's success in carrying out a reliable survey of an important tract of country—an achievement which was only brought about by indomitable steadfastness of purpose—gives the results of his expedition a definite geographical value, while in other fields the whole-hearted cooperation which he received from his comrades enabled him to accomplish a thoroughly successful enterprise. I now ask you to join me in thanking him and his party for the interesting evening they have afforded us.

THE CAMBRIDGE EXPEDITION TO SCORESBY SOUND, EAST GREENLAND, IN 1933

BRIAN ROBERTS

THE Cambridge East Greenland Expedition in 1933 was primarily a zoological enterprise. The party consisted of three members only: G. C. L. Bertram (St. John's) and D. Lack (Magdalene) zoologists, and B. B. Roberts (Emmanuel) organizer and surveyor. In 1932 the two former had carried out an ecological survey on Bear Island in the Barents Sea, and they wished to extend their work to the richer fauna of a continental area with very different physical and climatic conditions. Briefly, our plan was to make an ecological survey in a locality in East Greenland as a comparison with those made in other arctic regions: West Greenland (1928), Iceland (1932), Bear Island (1921 and 1932), Spitsbergen (1921–25), and Hudson Strait (1931). We also proposed to investigate the low-temperature range of active life of the common land arthropods in an attempt to interpret their observed geographical distribution, and to study a nunatak with a view to seeing what animals, if any, can withstand the conditions of life found there. In addition, all three of us were interested in ornithology, and I had the special wish to follow up observations on the feeding habits of birds begun during the Cambridge Expedition to Vatnajökull in 1932.

A generous grant was made by the Royal Geographical Society and further support was received from the Worts Fund at Cambridge and our three colleges. The finances and small personnel of the expedition clearly could not allow a specially chartered vessel or the taking of passages in one of the Danish supply ships from Copenhagen. We were therefore extremely fortunate when Dr. J. B. Charcot offered us passages out to Greenland in his ship the *Pourquoi Pas?* and invited us to be his guests throughout the voyage. He was taking an expedition to Scoresby Sound in connection with the relief of the Station *Paul Doumer*, the French contribution to the International Polar Year scheme, and very kindly agreed to leave us for as long as possible in Hurry Inlet, a subsidiary fjord running some 40 miles northwards from Scoresby Sound. This area was best suited to our purpose since it is said to have the richest vegetation in the whole of East Greenland. For this splendid generosity we can never be sufficiently grateful, and at all times Dr. Charcot and every one else on board did their utmost to make us comfortable and to further our aims.

We would like also to express here our most sincere thanks to Professor Debenham and his assistant, Miss Creswick, for their continual help; to Dr. T. G. Longstaff and Mr. J. M. Wordie for their encouragement and advice; and to Professor J. Stanley Gardiner for the loan of zoological equipment. I wish to acknowledge much assistance from my two companions over the preparation of the zoological part of this paper.

Historical summary

A complete history of the exploration of Scoresby Sound does not seem to have been published anywhere, and since I experienced some difficulty in finding out exactly what had been done there, I have thought it worth while to summarize here the result of my researches.

The first authentic knowledge of Scoresby Sound dates from 1822, when William Scoresby, Junior, made his notable voyage in the *Baffin* of Liverpool (1). During part of the time he was accompanied by his father, William Scoresby, Senior, in the *Fame*, and it was after him that the Sound was named. The son made his first landing on the Greenland Coast at Cape Lister and Cape Swainson on July 24. The next day he went farther up the Sound and met the *Fame*, which had already been searching for whales there for two days. Together they sailed up the channel separating Jameson Land from Liverpool Land, and with small boats explored it "to an extent of thirty or forty miles towards the north" without finding any termination. This channel was named Hurry Inlet after Mr. Nicholas Hurry, managing owner of the *Baffin*. The older man had seen two whales in the inlet, which encouraged his son to prolong his stay. A number of landings were made and a series of angles taken for his survey at Cape Hope and Cape Stewart. In the circumstances it is surprising that Scoresby's account is so full and reliable. The examination and survey had to be confined to the coast-line, since, as he says, "we could not unfortunately be justified in undertaking any travelling exploration, because in such, there could be no chance of capturing whales, or in any way promoting the chief designs of the voyage." His map shows Hurry Inlet as a channel joining up with Carlsberg Fjord to the north, thus making Liverpool Land an island. This latter received its name because the headlands and islands along the coast were nearly all called after friends in Liverpool. His father discovered the islands at the head of the fjord which were named after his ship the Fame Islands.

Scoresby brings out clearly the difference between the structure of Jameson Land and that of the rest of Greenland. "Jameson's Land," he says, "is of a totally different appearance and character from any other polar lands I have seen. At a distance it appears low and undulating, and of a light-brown colour; while all the surrounding coasts, with the exception of Perspective Ridge, are rugged, mountainous, and of a blackish-brown colour. And what rendered it still more striking at this time, was the remarkable freedom of the southern part from the least vestige of snow." One other quotation will suffice to give a good idea of the type of country: "The vegetation in Jameson's Land is superior to anything that I could have expected in such a latitude. About the [Eskimo] hamlet [at Cape Stewart], the ground was richly clothed with grass, a foot in height; and more inland, my Father, who explored this country to a great extent, discovered considerable tracts that might justly be denominated *greenland*, patches of several acres, occurring here and there, (according to the testimony of Mr. Scott, surgeon of the *Fame*) of as fine meadow-land as could be seen in England." It is worth noting that this was the only year in which Scoresby landed in East Greenland, although he made some twenty whaling voyages between 1803 and 1823.

The full extent of the Sound was charted for the first time by the Danish expedition of 1891–2 under Lieut. C. Ryder. The work of the party was chiefly concerned with the geology of Jameson Land. In August 1891 the *Hekla* sailed into Hurry Inlet, which was discovered to be a closed fjord instead of the continuous channel which Scoresby had supposed. A comparatively good sketch-map of the Inlet accompanies Ryder's report (2), but little more

than the coast-line is shown except for the two conspicuous glaciers which descend from Liverpool Land about half-way up the fjord.

In 1899 a Swedish expedition under Professor A. G. Nathorst (3) was sent out to East Greenland in the *Antarctic* to look for Andrée and his two companions who had disappeared in the balloon *Örnen* two years before. At the beginning of August the ship paid a brief visit to Hurry Inlet while waiting for ice conditions to improve farther north. The previous observations on the Jurassic deposits of Jameson Land were supplemented, and a survey was made of a small area north of the Inlet showing the lower part of Ryder's River. The following year the *Antarctic* again sailed for Greenland with the Danish Amdrup-Hartz Expedition (4). After leaving Amdrup and his companions at Cape Dalton for their great boat journey southwards to Angmagssalik, the ship traversed the coast northwards as far as Scoresby Sound. Hurry Inlet was visited at the end of July and about twenty days spent in Jameson Land. Again the Jurassic deposits were the chief attraction, and Otto Nordenskiold, the geologist of the party, published a detailed paper of their results with a sketch-map of the region (5).

After 1900 there was a long gap in the exploration of Scoresby Sound. The gradual development of hunting by Europeans along the North-East Greenland coast made desirable the establishment of an Eskimo settlement as far north as possible to protect the economic interests of the natives farther south. In July 1924 Captain Ejnar Mikkelsen sailed from Copenhagen in the *Greenland* and laid the foundations of a colony in Rosenvinge Bay on the north coast of Scoresby Sound (6) (see p. 247). Seven men remained until September 1925, when Captain Mikkelsen returned for them in the same ship, rechristened *Gustav Holm* (7). The party included a zoologist, Alwin Pedersen, who made some valuable observations on the fauna of the region (8). The Settlement formed a good base for detailed scientific work, and since then it has been visited every year by at least one ship. In 1926 Dr. Lauge Koch used the Settlement as the base for his geological investigation of the coast between Scoresby Sound and Danmarks Haven in Germania Land (9). During Koch's sledge journeys northwards his two companions, A. Rosenkrantz and T. Harris, were able to carry out a thorough geological investigation of Hurry Inlet and make a large collection of fossils in Jameson Land. The party wintered at the colony and were greatly assisted in their hunting and travelling by the Eskimos. This principle was also adopted by Alwin Pedersen, who made a second visit to Scoresby Sound from August 1927 to August 1929. His numerous sledge journeys to the interior of the fjord, and down the Blosseville coast to Cape Dalton, resulted in some interesting discoveries and a greatly improved map of the area (10). Pedersen's zoological work is especially noteworthy (11).

Finally, the expeditions in the *Pourquoi Pas?* under the command of Dr. J. B. Charcot must be mentioned (12). With the exception of 1927, Dr. Charcot has visited Scoresby Sound every summer since 1925. The work done has been mainly of a hydrographic nature, but considerable collections of fossils and arthropods have been made, and also sketch-maps of some of the regions visited. During 1932–3 the French International Polar Year Station was established in Rosenvinge Bay. The *Pourquoi Pas?* was accompanied

by the French Naval ice-breaker *Pollux*, which assisted in transporting their equipment and personnel. The results of this expedition are in course of preparation.

It will be seen that most of those expeditions which visited Hurry Inlet have had the Jurassic deposits of Jameson Land as their primary interest. The object of the Cambridge Expedition of 1933 was to continue the work of Alwin Pedersen and to concentrate chiefly on the biological problems of Jameson Land.

The 1933 Expedition

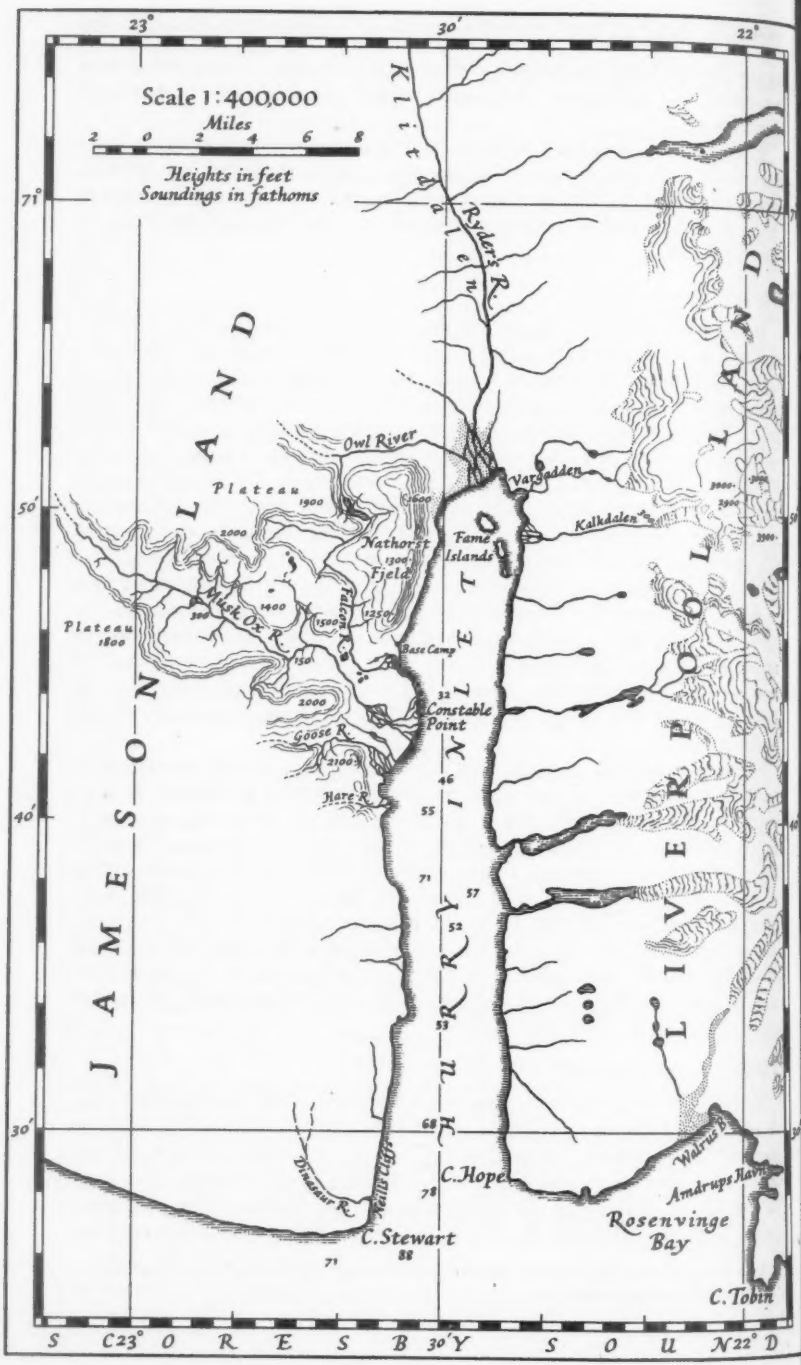
It was arranged that we should join the *Pourquoi Pas?* on July 18 at Akureyri in North Iceland, when she called there to coal and water on her way northwards. In England we purchased an old 16-foot dinghy and fitted her with a lugsail so that we could be quite independent of the ship when left in Hurry Inlet. This boat, with provisions for five weeks, camping gear, and a considerable quantity of zoological equipment, formed our baggage when we left Hull in S.S. *Dettifoss* on July 4. We landed at Reykjavik and sent our things on to Akureyri by sea. The two weeks enabled us to make the crossing by land and to visit Mývatn (Fly Lake) and Dettifoss, Iceland's largest waterfall, situated at the northern end of the great lava desert of Ódaðahraun. Our whole time was taken up with ornithology (13) and a few practice excursions in the dinghy until the *Pourquoi Pas?* arrived early on the morning of the 18th. The same day a wireless message from the colony in Scoresby Sound announced that ice conditions were very bad at the entrance of the fjord. The start had to be postponed for a week, and we took advantage of the delay to make a hurried visit to the little-known island of Grímsey, 30 miles off the Icelandic coast.

Grímsey is difficult of access and has consequently got the reputation of harbouring a number of rare birds not found elsewhere in Iceland. It is an island of peculiar interest; only $3\frac{1}{2}$ miles long and $1\frac{1}{2}$ miles wide, with about 130 inhabitants who subsist mainly by fishing and bird snaring. We spent five days making a thorough survey of the bird life, and found none of the doubtful species breeding. It is remarkable that the colony of Little Auks here, the most southerly in the world, has been reduced to only five pairs. The ornithological results of this trip are being published separately (14), and as another Cambridge expedition is going out to Grímsey in the summer of 1934 to make a topographical and ecological survey of the island, no further description will be given here.

The voyage to Greenland

Early in the afternoon of July 24 we left Akureyri in the *Pourquoi Pas?*[1] and three days afterwards reached the edge of the pack-ice 110 miles from Cape Brewster, the southern headland at the entrance of Scoresby Sound. At first there were only occasional lumps of ice drifting past in the fog, but some 12 miles in from the edge the pack thickened considerably and the fog compelled us to stop and wait for better conditions. The ice anchors were fixed

[1] A more detailed account of the voyage is being published by Dr. Charcot in 'Annales Hydrographiques.'


Scale 1:400,000
Miles
2 0 2 4 6 8
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23°
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22°
71°
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40′
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Kitdlen
Ryder's R.
Owl River
Plateau
1900
2000
1600
Nathorst
1300
Fjeld
Fame
Islands
Varsuddan
Kalkdalen
Musk Ox R.
1400
1500
1250
Falcon C.
Base Camp
Plateau
1800
150
2000
Constable
Point
Goose R.
2100
Hare R.
46
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52
53
68
72
88
71
Kaill Cape
Dinosaur R.
C. Hope
Walrus B.
Andrups Havn
Rosenvinge
Bay
C. Stewart
C. Tobin
JAMESON LAND
LIVERPOOL LAND
SCORESBY SOUND
23° 30′ 22°

to a large floe while we all landed on the ice for exercise. The thick fog compelled us to remain for about sixteen hours, and when it lifted we found ourselves confronted with an almost unbroken sheet of ice. There was nothing for it but to retrace our course and try again farther north, this time with success. Greenland was sighted as we left the pack, 40 miles from the coast, and late on July 28 we cast anchor opposite the Eskimo colony in Rosenvinge Bay. Two boats put off from the shore bringing the members of the Polar Year party out to the ship, and after their twelve months' isolation the exchange of news occupied the whole night. We spent five days in Rosenvinge Bay. The station had been erected on a hillside just east of the settlement, and was extremely well fitted out with equipment for their work. While arrangements were being made for the evacuation of the station, we had an opportunity of seeing something of this very interesting Eskimo settlement which was founded only as recently as 1925, and which, it is hoped, will be the forerunner of a chain of colonies running still farther north along this difficult stretch of coast (see p. 247).

Hurry Inlet

The ice-breaker *Pollux* had arrived from Akureyri on July 30, bringing with her our sailing dinghy which was now transferred to the *Pourquoi Pas?* At mid-day on August 1 we left the colony and sailed along the south coast of Liverpool Land and up Hurry Inlet. The following morning we were put ashore at Constable Point, a delta about half-way up the western side of the fjord. It had been decided that the *Pourquoi Pas?* should visit Milne Land in the interior of Scoresby Sound where her scientists were to be landed to make a survey and carry out geological work. The *Pollux* was to take the Polar Year party back to France, and the *Pourquoi Pas?* would return for us about August 15. Our base camp was established in a narrow sandy gully at the northern end of the delta. It was not a very satisfactory pitch, a gale having made it impossible to choose a good place for landing. Blowing sand and a very poor water supply were the two chief drawbacks, but we were close to our chief working ground, the well-vegetated valley system west of Constable Point.

Hurry Inlet is bounded on the west by Jameson Land and on the east by Liverpool Land. The former is of a totally different appearance from any other region in East Greenland. It is not rugged and mountainous like the country on the other side of the fjord, but consists of an undulating limestone plateau with occasional outcrops of basalt, averaging about 2500 feet in height. Where they are exposed on the south-western margin of Hurry Inlet the rocks of Jameson Land consist of richly fossiliferous Jurassic deposits, but the remainder is almost entirely covered by Quaternary drift. The plateau itself, even at its highest parts, is free of snow in midsummer. Only a few patches of snow persist in depressions and at the bottom of the deep valleys. It is much dissected, leaving bare-topped hills and well-vegetated valleys. The valley bottoms were carpeted with a heath composed chiefly of bell heather (*Cassiope tetragona*), willow (*Salix arctica*), dwarf birch (*Betula nana*), bilberry (*Vaccinium myrtillus*), and small patches of *Vaccinium uliginosum* and various grasses. As the valley slopes were followed upwards, the rich vegetation

rapidly gave place to scattered plants. Here *Dryas integrifolia* was common with small clumps of moss campion (*Silene acaulis*) and the purple saxifrage (*Saxifraga oppositifolia*). Everywhere in the sand and sun-baked mud near the camp were arctic poppies (*Papaver radicatum*) and the small white flowers of *Polygonum viviparum*. Bright patches of pink willow herb (*Epilobium latifolium*) occupied the banks of the streams, and on Constable Point large areas of marshland, dominated by white sheets of cotton grass (*Eriophorum scheuzeri*), separated numerous pools of fresh water. Nearer the sea the vegetation gave rise to miniature sand dunes, and finally one reached a tidal lagoon beyond which was an outer beach of bare sand and shingle.

Such were the surroundings in which we found ourselves on August 2. There seemed to be little doubt that the richest vegetation in East Greenland was to be found on the shores of Hurry Inlet. As soon as we had unpacked our collecting apparatus and got the camp in order we set out to begin working the country in the neighbourhood. Our programme while at the base camp was much the same from day to day. The continual sunshine and calm weather allowed long hours, and the knowledge of having so short a time led us to reduce camp work to a minimum. Lack spent most of his time making a large collection of insects and spiders which is probably the most extensive yet made in East Greenland. He would collect the larger and more obvious species among the vegetation and under stones with a net and sucking tube, "the entomologist's vacuum cleaner." Returning to the tents to sort out his captures, he would set going the Berlese funnel, an ingenious device which gathers together minute insects by heating the moss containing them, so driving them downwards into a tube of alcohol below. By using this funnel a large number of minute animals can be captured which would otherwise escape observation; a further advantage is that the apparatus may be filled with boiling water and then left to itself, while the human collector can go off and work elsewhere. It was particularly useful when "running through" the moss and other plants brought back from a nunatak in Liverpool Land. The chase of certain swift-flying butterflies and bees was sometimes suddenly cut short by the close approach of a Musk Ox, causing a rapid retreat and renewed activity in the opposite direction. The majority of the insects were, of course, among the thicker vegetation along the bottoms of the valleys. In the evening, with the falling temperature, they became dormant and disappeared into holes and crannies, a reaction to cold fortunately shared by the midges and mosquitoes.

Bertram visited all the ponds and streams in the district and investigated the freshwater fauna. Most of his time however was taken up with experimenting on the reactions of insects to low temperatures. It has often been supposed that the smaller forms of land animals of the arctic such as insects and spiders are limited in their geographical range by the lethal effects of the lowest winter temperatures upon the over-wintering stages in their life history. Since however beneath a blanketing of snow, temperatures are known not to sink very many degrees below freezing-point, it seemed possible that this explanation was not well founded and that perhaps the geographical limits of the species' range might more readily be explicable by the ability or otherwise of the adult stage to maintain an *active* life in the temperatures afforded by the

arctic summer. Bertram therefore devised an apparatus in which insects and spiders were placed and where the temperature could be lowered to any desired degree in a dry atmosphere. The lowest temperature at which each species could remain active was noted. The species varied very considerably. For example, a bee and one species of beetle were rendered inactive at 10° C. and other forms of various orders at 9° C.; while on the other hand certain small flies and spiders were able to retain their activity several degrees below freezing-point. Individuals of the many other species experimented upon were found to be intermediate in their reactions between these two extremes.

This represents an attempt on somewhat new lines to correlate the geographical distribution of arctic forms with a factor that can be investigated experimentally. It is too early to say much until the results have been more fully studied, but a number of the insects found in 1932 on Bear Island occurred also in Hurry Inlet. In Bear Island all these forms were active at fairly low temperatures, the average July temperature being 4·5° C. On the other hand, many of the forms in Hurry Inlet did not occur on Bear Island, and indeed could not, since there they would so extremely rarely be capable of any activity at all. These experiments suggest a possible explanation of the marked variations in the numbers of individuals of a species that may occur from year to year in arctic countries. The summer temperatures vary considerably, and if in one year for instance only five days reached a temperature great enough for a particular form to become active, a lesser number of eggs would be laid than in a year where perhaps twenty days exceeded that "critical" temperature. Such variations would greatly affect the numbers of individuals appearing in the next year.

Apart from ornithology, my own time was chiefly taken up with a compass survey of the area in which we worked. On the first day a base-line was measured on the mud flats of Constable Point. From this a triangulation was extended up Musk Ox River and northwards across to Owl River. A map of the coast-line had already been published in Copenhagen, so the work consisted chiefly of visiting the whole area and sketching in the detail. Every evening when we returned to camp it was possible to make up a big fire of driftwood round which to sit and write up our notes. There were always birds to be skinned or collections to be packed away, and often the blazing logs outside the tents with the ice-floes drifting past in the fjord would keep us up until the early hours of the morning, struggling hard to keep awake and enjoy the world a little longer.

By August 8 we had covered most of the country within reach of the base camp, and started out across the fjord in our dinghy which had been christened *Phalarope*. None of us had had much previous sailing experience, so navigating between the constantly moving pack-ice provided some anxious moments. Our work required a good deal of equipment which filled most of the boat. For financial reasons she was not entirely seaworthy, so that much time was occupied with bailing. The first night we camped on the northernmost of the Fame Islands, the small group of rocks in the centre of the fjord which were invaluable as a refuge when the wind changed and the Inlet filled with closely packed ice. On these islands and everywhere else we went except Constable Point, there were perfect little sheltered harbours in which the *Phalarope* was

safe from the ice. Next morning we sailed across to Liverpool Land and found a good anchorage at the mouth of the river flowing from Kalkdalen (Limestone Valley) which had been visited by Nordenskiold in 1899. We followed up the river through a gorge into an extraordinarily fine example of a rock basin. Above the rock barrier it spread out over a wide gravel plain, with very similar vegetation on the valley slopes to that found on the other side of the fjord. About 5 miles from the sea a glacier descended from the ice-cap and widened out into a broad fan-shaped tongue from which the river issued. It was easily recognizable as the unnamed glacier appearing in a painting by E. Ditlevsen, a member of the Amdrup-Hartz Expedition (15). Some extraordinarily well-developed stone polygons similar to those which have been described from Spitsbergen, were a marked feature of this valley. Stone polygons were not found in any of the valleys of Jameson Land, but in several places areas of mud polygons occurred on the alluvial flats. A few sandy areas on top of the plateau were paved with a mosaic of small ferruginous concretions in limestone, many of them containing fossil nuclei; and in some cases frost action had arranged these in polygonal formation.

From the Fame Islands we had seen a nunatak some 6 miles in from the edge of the ice-cap, and it was an easy matter to reach this by ascending the glacier and walking across the intervening snow. A long climb brought us to the summit and we were able to carry out our plan of searching for any fauna which might be present (see p. 244). The top of the nunatak commanded a very fine view, and from it we could see that the Liverpool Land ice-cap is much smaller than indicated on the maps. From the foot of the peak a big glacier with a well-marked central moraine flowed eastwards into the sea north of Glasgow Island. It is impossible to speak of a real ice-cap in Liverpool Land south of this point. The country is deeply intersected by valleys and the ice is mainly collected in these and in depressions between the peaks. Northwards a fairly flat ice-cap extended as far as could be seen. Many nunataks broke its surface, mostly identical with the peaks which can be seen from the east coast. Farther west the confused deltas at the head of Hurry Inlet stood out like ribbons of silver, and behind Jameson Land were range after range of sharp-pointed mountains running back to the central Greenland ice-cap over 100 miles away. We did not get back to the camp until well on into the next day. The unexpected narrowness of the snowfield had induced us to cross it completely instead of making only the short journey to a nunatak at the top of the western glacier. We sailed back to Constable Point, arriving on August 12. Another boat journey to Liverpool Land from August 13 to 15 enabled us to collect in the two glacier valleys south of Kalkdalen. There are four main glaciers on the east side of Hurry Inlet; not two, as marked on all the maps. Only the three southern ones contain lakes. The margin of the fjord is low-lying and extremely regular. With the exception of the glacier valleys the land is ice-free and rises gradually with a gentle slope to the mountainous region we had seen from the nunatak.

We were back at Constable Point again on August 15 and on the morning of the 17th the *Pourquoi Pas?* was sighted near the mouth of Hurry Inlet. Four hours later we had everything packed and down on the beach, but a gale had sprung up and it was too dangerous to set out in our small boat. She was

anchored safely in a lagoon, but when we came in the morning we found her in a lake with no outlet to the sea. A sand-bar had been built right across the entrance during the night, so reluctantly we had to abandon her there and be taken off by one of the ship's boats. That night the first snowfall of the coming winter covered the hill tops. The short summer was already nearly over.

Fauna

The zoological work covered all the land and freshwater groups, but was concentrated chiefly on the arthropods, which had received very little attention from Alwin Pedersen, the only previous zoologist to have visited the region.

Of mammals, the Musk Ox was perhaps the most interesting. Scoresby Sound is the southern extremity of their range in East Greenland. The reason for this is the complete lack of suitable grazing grounds south of Cape Brewster, and also the presence of numerous glaciers flowing direct into the sea whose crevassed surfaces form an effective barrier to any movement farther south. It has recently been said, though hardly with sufficient evidence, that the numbers of Musk Oxen on the east coast are decreasing. In Jameson Land they are certainly very common now, and the presence of groups of skeletons suggests that their abundance in this area has been known to hunters. There were about eighty individuals in the valley of Musk Ox River, and we saw many others farther north along Owl River and across the fjord in Liverpool Land. Judging from the reports of other expeditions working north of Scoresby Sound in 1933 there is little immediate reason to fear their extinction. The American expedition, under J. K. Howard, counted 209 individuals on Andrée Land, Strindberg Land, and Ymer Island during July 1934. Their most favourite feeding ground was a thick heath composed mainly of *Cassiope tetragona* with patches of willow (*Salix arctica*), and scattered tufts of a variety of grasses (*Poa* spp. and *Carex* spp.). We constantly met with herds of eight or ten wandering slowly over the country. It is as well to remember that it is not safe to approach the solitary old bulls too closely, but their habit of almost invariably charging uphill when alarmed makes it possible to pass safely below them on a hill-side.

Reindeer are now extinct in East Greenland, but everywhere in Jameson Land their antlers indicate that they were once abundant. Ryder's Expedition (1891–92) found them "in very great numbers" in Jameson Land. Nathorst saw only two when in Hurry Inlet in 1899, and next year the members of Amdrup's party saw none. Some say that they were exterminated by wolves when there was an influx of these animals at the beginning of this century, but there is no real evidence for this assertion. No Lemmings or Ermine were seen by us, although traces were numerous. Alpine Hares were common in restricted areas, keeping to the higher ground, and only feeding in the evening. The abundance of Foxes became noticeable when they were attracted by our meat supply.

In Hurry Inlet we saw only one Fjord seal (*Phoca foetida*) and four Bearded seals (*P. barbata*) during our stay. The Hooded or Bladdernose seal (*Crystophora cristata*) was quite common in the pack-ice, but was not seen anywhere near the coast or in the fjords. A Walrus was killed at the entrance to Scoresby Sound on August 16, and two Narwhals were killed out of a small herd on

July 27. The comparative absence of game in Scoresby Sound and Hurry Inlet is clearly due to the proximity of the Eskimo colonies. The nineteen hunters annually shoot about four thousand seals for food, and the extent of the hunting is shown in the following table which gives the number of skins sold to the store by the natives since the foundation of the colony:

	Seal	*Bear*	*White fox*	*Blue fox*	*Narwhal tusks*
1925	—	5	22	39	—
1926	27	102	45	61	4
1927	102	72	49	41	15
1928	252	73	131	76	29
1929	626	64	48	33	14
1930	524	77	32	29	3
1931	383	34	54	51	5
1932	372	55	132	44	—

The Harp, Saddleback, or Greenland seal (*Phoca groenlandica*) is hunted by Europeans in the pack-ice of Denmark Strait, but it does not occur on the coast. If hunting in East Greenland is carried on under careful European control there is little reason to suppose that the food supply for the Eskimos will be extirpated.

Owing partly to the extra delay due to bad ice conditions, and also to the extensive non-breeding of birds in the summer of 1933, we were unable to carry out fully the original ornithological programme we had planned. Only a few skins were collected as the nesting season was almost over, and many species were already going into winter plumage. To some extent however we were able to supplement Alwin Pedersen's work. The breeding of the Lapland Bunting and Red-necked Phalarope was proved farther north in East Greenland than hitherto known. The Meadow Pipit was recorded farther north than previously, and fresh suggestive evidence that the Golden Plover breeds in Greenland was obtained. A number of common water birds were found to be nesting in extremely reduced numbers or not at all. These remarkable periodic bad years, whose cause is still far from certain, must have a marked influence on the numbers of a bird population in arctic countries. This phenomenon, together with our other ornithological results, is discussed in a separate paper (16).

One of the original objects of the expedition was to investigate the fauna of a nunatak. The question of whether a glaciation would kill off all the land life of a particular area has been long in dispute, both with regard to arctic countries and to Britain itself. There seems a strong probability that, however severe the glacial conditions, there would always be some areas (nunataks) uncovered by snow in the locality concerned. Hence an investigation of the fauna of a Greenland nunatak might throw light on the capabilities of animals to withstand a glaciation. The nunatak which was selected was a peak 3000 feet high in Liverpool Land. On the west side it was bounded by some 6 miles of ice-cap. On the east, two large glaciers separated it from mountains nearer the sea. Hence it was not so satisfactory as a nunatak surrounded on all sides by the ice-cap, but it was the most suitable that was accessible, and probably

conditions were not very different there from what they are on other nunataks. We reached it at midnight on August 9, when the temperature was well below freezing-point. A fair amount of vegetation was found, consisting of both Cryptogams and Phanerogams. Samples of soil and vegetation were collected and, on return to the base camp, these were analysed by the Berlese funnel.

Two orders of insects were represented. Three small species of Collembola were found, a few larvae of a Chironomid fly, and a small spider. The last may not have been a resident on the mountain but might have been recently transported there by wind. The collection shows that two of the groups of small animal life most common in the arctic could withstand the most barren conditions afforded by snow-free land in the arctic and so could presumably withstand any glaciation where nunataks are left. There is therefore no need to presume that all the animal life found on arctic and sub-arctic islands has colonized since the last glaciation.

In connection with this it is interesting to note the results of Gunnar Seidenfaden. In a recent paper on the botany of south-east Greenland (17), he concludes that "all the geological and botanical observations in Greenland of recent years seem to me to suggest that a far larger number of plants than previously assumed have survived the great glaciation in Greenland." On the other hand it seems quite possible that no nunataks remained ice-free on the East Greenland Coast. Mr. N. E. Odell informs me that he has found erratics on most of the mountain summits he investigated in the Franz Josef Fjord area, and the glacial drift on Jameson Land indicates that the region north of Scoresby Sound was probably also completely covered by the ice. The question of survival would therefore be more applicable to such regions as Iceland, where there is definite evidence that the glaciation only reached a certain height on the mountains.

Insects and spiders were collected mainly round Hurry Inlet, but small collections were also made at Rosenvinge Bay, Cape Dalton, and D'Aunay Fjord. All the main groups of insects were collected except the mammal and bird parasites. Owing to the lateness of our visit the collection cannot be regarded as complete, for forms which emerge only earlier in the summer must have been overlooked. The collection, which has been presented to the British Museum (Natural History), emphasizes how much poorer the insect fauna of East Greenland is as compared with the West coast. (Nine orders were represented, namely, Collembola (Springtails), Thysanoptera, Hemiptera (Plant bugs and Aphids), Trichoptera (Caddis Flies), Lepidoptera (Butterflies and Moths), Coleoptera (Beetles), Hymenoptera (Bumble bees and Ichneumon Flies), and Diptera (Flies). As in other parts of the arctic, Diptera constituted the bulk of the forms.)

Except for the Diptera, all the insects and spiders have now been identified, and an account of the spiders by A. R. Jackson, of the parasitic Hymenoptera by A. Roman, and of the other orders by D. Lack, has appeared in the *Annals and Magazine of Natural History* (Ser. 10, vol. xiv, pp. 599–620, 1934). Of the forms identified, one species of spider, one of ichneumon fly, and one moth are new to science. The last of these has been named by E. Meyrick (18) in honour of Dr. J. B. Charcot. In addition, four species of springtail, one aphid, one other species of ichneumon fly, and one other species of moth have not

previously been recorded from Greenland; and several other forms are new to East Greenland but have previously been recorded from the West coast. A consideration of the forms already identified tends to confirm the view that the affinities of the East Greenland fauna, other than birds, are nearctic rather than palaearctic.

A collection of freshwater crustacea by Bertram has been handed over to be worked out at the University Museum of Zoology at Copenhagen.

The Blosseville Coast

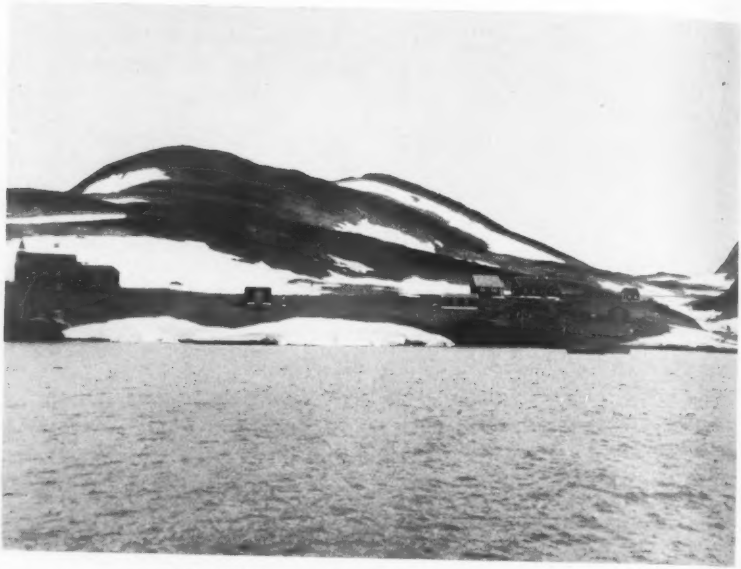
When we were picked up in Hurry Inlet on August 18 the *Pourquoi Pas?* sailed straight for Rosenvinge Bay. She had been under bad ice pressure there the week before, and Scoresby Sound was now full of heavy pack-ice. The *Pollux* had sailed two days before, taking with her the Polar Year party and their equipment. After further visits to the Eskimo colony, we steamed out of the bay early on August 19. The ice caused a good deal of difficulty until we got to the entrance of the sound, but there we reached open sea with no pack in sight and only innumerable icebergs scattered along the coast. Conditions were so excellent that Dr. Charcot decided to sail down the Blosseville Coast south of Scoresby Sound. This coast-line had been sighted for the first time exactly one hundred years before by the French Naval Lieutenant Blosseville, who returned to Iceland to send home the news and then perished in an attempt to reach it. It was thus most appropriate that another French ship should traverse it on the centenary of its discovery. Usually the Blosseville Coast is very difficult of access and it was not mapped until Amdrup's famous boat journey in 1901. Captain Mikkelsen, who was a member of that party, took out another expedition in the summer of 1932 (19). He was able to carry on Amdrup's work in much greater detail, and to erect a series of huts and food depots to form a link between Angmagssalik and Scoresby Sound for any Eskimos who may undertake the difficult journey between the two colonies.

Late in the evening we reached Cape Dalton and anchored off Amdrup's depot, where he wintered before going south. The hut was in good condition, having been repaired and reprovisioned by Mikkelsen the previous year. We went ashore to visit the tertiary bed, and the French geologists made a large collection of fossils. It was here that we encountered our first Polar bears. At one time five were in sight at the same time, which is rather a remarkable sight in summer time. A female and two cubs were watched rolling in the mud by a stream, and when they later entered the sea we gave chase in two of the ship's boats and were able to photograph them swimming at close range.

The next stop was at D'Aunay Fjord, which extends considerably farther inland than is indicated on Amdrup's map. The inner part of the fjord contains heavily silt-laden water brought down by a fair-sized river issuing from the end of a glacier a few hundred yards inland. Here we were delayed some time by heavy masses of fog drifting out at sea. It is impossible to navigate among so many icebergs with safety during a fog, but the fjord provided a safe refuge. On the morning of August 22 the fog cleared and we were able to put to sea again. The scenery of King Christian IX Land is extremely fine. The coast is deeply indented with fjords from which precipitous black basaltic

Dr. Charcot's ship, the "Pourquoi Pas?"

The expedition's dinghy "Phalarope" in Hurry Inlet



The Eskimo settlement in Rosenvinge Bay

Part of the northern Blosseville coast

mountains rise straight up from the sea to a height of about 3000 feet. We sailed along past innumerable glaciers descending from the inland ice, and then turned eastwards towards Iceland at Cape Grivel. The sea was quite free of pack-ice, and an uninterrupted sail brought us to Reykjavik only thirty-eight hours after leaving the Greenland coast. Six days were passed in Iceland, and then we set sail once more. *Pourquoi Pas?* was making for Brest, but Dr. Charcot arranged to put us ashore on the west coast of Scotland on his way south. Barra Head was sighted at midday on September 2, and late the same night we entered the Sound of Mull and dropped anchor in Tobermory Bay.

A Note on Eskimo Colonization in East Greenland

All along the east coast of Greenland from Angmagssalik to the most northerly point of land are to be found signs of a once flourishing Eskimo population. The remains of stone huts, skeletons and bone implements indicate that a high order of hunting culture had been reached, but for some unknown reason the race became extinct, and the land was left empty of people. Only once was the original North East Greenland Eskimo seen by a European, when Clavering in 1823 saw twelve of these people who ran away at his approach on the island which now bears his name.

Since then a scheme of recolonization has been set going by Danish enterprise.[1] In 1884 Gustav Holm discovered a settlement in the Angmagssalik area, where there was an Eskimo tribe which had never previously come into contact with Europeans. It is now fifty years since this settlement was discovered. The original population numbered 413 individuals, and at that time the east coast people were all migrating southwards with the intention of settling on the west coast where conditions were known to be more favourable. The settlement was not brought under Danish administration until 1894, ten years after its discovery, and the population had then dwindled to 243. About 110 Eskimos were then actually *en route* for west Greenland, but returned to Angmagssalik when they heard about the establishment of the trading station. It can thus be seen that without the encouragement of the Danish assistance, probably none of the native population would have remained on the east coast.

It was soon realized that provision would eventually have to be made for an extension of this settlement owing to the rapid increase in numbers, and after further exploration it was apparent that Scoresby Sound, 400 miles to the north, would fulfil the necessary conditions. It was also most important that hunting in this area should be brought under control in order to ensure an adequate supply of game for the Eskimos.

When in 1924 the East Greenland Treaty between Denmark and Norway was concluded, Scoresby Sound was reserved for the new colony. A private committee, called the Scoresby Sound Committee, was formed to carry the scheme into effect. The same year an expedition under the leadership of Captain Ejnar Mikkelsen, sailed for Greenland, erected a number of houses

[1] The writer is much indebted to Capt. Ejnar Mikkelsen for criticizing this section.

and left a depot of food and equipment in a suitable locality on the northern shore of Scoresby Sound. The finished settlement was handed over to the Danish Government, who next year transferred 85 Eskimos from Angmagssalik to Scoresby Sound, together with all their possessions. The population of the east coast had increased rapidly and had then reached about 965, a rise of over 600 in 30 years. It was hoped that this scheme would not only relieve the over-population of the Angmagssalik area, but would at the same time preserve the Eskimos as a contented hunting people away from the disadvantages of civilization, yet giving them certain of its benefits. The northern colony, after nine years, is now well established, and although it is still perhaps early to express a definite opinion, the impressions gained by a visiting expedition last summer may be of interest.

The colony consists at the present time of about 150 Eskimos, who live in three settlements some 5 miles apart: Rosenvinge Bay, Cape Tobin, and Cape Hope. The settlement which was established at Cape Stewart, farther west, transferred itself *en masse* to Cape Hope, as it was found that the former was too distant from the open sea for winter hunting. At Rosenvinge Bay there is a sheltered anchorage, and it is there that the Governor lives, and the store and church are situated. The settlement is constantly being extended, and in 1927 the Government erected a wireless and seismograph station, which is operated by a resident Dane. The same year a beautiful church was presented by a member of the Scoresby Sound Committee. A native priest from the west coast had come with the first settlers. The Eskimos have been provided with well-constructed houses of European appearance. At Cape Hope an outcrop of coal is utilized, the products being removed by sledge in winter. Since the foundation about fifty children have been born, so that families are large and the proportion of adult hunters is small.

The entire local administration is carried out by a native from the west coast, who is half Danish. Government laws are not enforced in Scoresby Sound as they are on the west coast. Should any offence happen, the priest and district governor inquire into the case and agree on some kind of punishment which usually takes the form of exclusion from some ceremony or a fine. The facts of the case and the verdict are then wirelessed to Copenhagen for the approbation of the Minister for Greenland, and finally the punishment is brought into force. It will be seen therefore that control depends very greatly on the personality of the district governor.

The store is under the management of the governor, and from it the Eskimos can obtain the more necessary commodities at any time. Some European foodstuffs are always in stock, but these are all of the simplest kind—ryemeal, barley, peas, sugar, etc. The cereals are principally kept as an emergency ration, or in case of illness. A monetary system is in use, under which the natives receive standard prices for skins, oil and other local products. Price fluctuations in Denmark are, so far as possible, not passed on to Greenland, and prices tend to be lower than at home.

The natives cannot be entirely dependent on the store because their annual incomes are too small. The average per hunter during the last seven years was Kr. 289, and they all have families to support averaging five individuals. This gives only Kr. 60 a year for each individual to cover all European produce,

and the wildest luxury they are supposed to indulge in is coffee. The district governor and priest alone can order goods from Copenhagen, and European luxuries in the ordinary sense of the word cannot be obtained by the natives. All transactions by members of visiting expeditions must be carried out under the direction of the governor. Contact with the outer world comes only through the medium of the annual Danish supply boats, and of the scientific expeditions which frequently make short visits to Rosenvinge Bay.

It must be remembered that although the Eskimo may be highly skilled in such arts as hunting and the construction of *kayaks*, his mind is more comparable to that of a child. It is thus perhaps not unnatural to find that his initiative is readily superseded by his willingness to copy, and consequently the members of all visiting expeditions carry with them a peculiar responsibility. Particularly must this apply to those staying over long periods, and even a single individual is capable of doing serious harm to the community by a thoughtless word or action.

It is a pity that, contrary to regulations, the Eskimos have in recent times received many presents from explorers. This practice is of no consequence when the gifts are in the nature of toys or trifling luxuries, but when they are necessities of life such as food and clothing, the inevitable result has been to relieve the natives of work, and to cause laziness. The Eskimos exercise little forethought, and seldom make provision for hard times. They spend at once any money which they receive in exchange for skins, and if not requiring necessities, purchase any trifle that takes their fancy, or which they have seen in the possession of another.

The Danish Government has attempted the difficult task of conserving the herds of Musk Ox, both to prevent their extinction and to act as a permanent reserve of food for the Eskimos in case of necessity. The latter have come to realize that they will not be allowed to starve, and this knowledge in itself may be partly responsible for their present lack of foresight.

As a result of these influences many of the original arts are degenerating. No longer do the Scoresby Sound Eskimos roll their *kayaks* for practice or pleasure, as was the case at the foundation of the colony. To-day, except in times of emergency, they will do so only when paid, complaining even in midsummer that the water is too cold. With the growing ease of obtaining necessities, the Eskimo are no longer fully occupied, and this condition has led to idleness and sometimes to the growth of petty quarrels. It is clear, then, that the influence of the local governor must be the deciding factor in the success of the colony. Those who were responsible for the founding of the colonies on the east coast are agreed that the best possible thing to do would be to leave the people strictly alone to live their life as in past generations. But it was absolutely necessary to establish these colonies, as the east coast Eskimos would otherwise have been extinct by now. It was also absolutely necessary to bring the natives under semi-civilized conditions, and it was unavoidable that they should acquire a desire for European foodstuffs and clothing. It seems inevitable that every visiting expedition is bound to have a certain amount of bad influence on the natives, but this can be minimized by a strong governor having the power to prevent anything he disapproves of, particularly the giving of presents in the form of food.

In the administration of East Greenland the Danish Government has embarked upon a very necessary and most difficult task. The Scoresby Sound Committee made a splendid and successful effort when it founded the Colony, but it seems doubtful whether the fullest success can be attained unless its visitors fully realize their responsibilities. The Danish Government has made its regulations wisely. Greenland is a closed land, except for those in pursuit of science and art, and it should be the wish of all who are permitted to visit the country to do everything in their power to assist. Denmark does not look upon Greenland as a territory to be exploited. Only the cryolite mines at Ivigtut, on the west coast, are worked commercially for profit. Beyond this, economic control rests entirely with the Greenland Administration at Copenhagen, who consider themselves as trustees for the individual welfare of the Greenlanders. Their recognition of this fact is interpreted as an obligation to guide the natives to a higher level of civilization and at the same time to preserve them from the many difficulties on the way.

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Note on the Map

The map illustrating this paper has been compiled from all the material up to date. It is based on the 1 : 230,000 map published by Grønlands Styrelse in 1900 under the title of *Grönlands östkyst, Indsejling til Scoresby-sund*. We are much indebted to the Geodetic Institute at Copenhagen for supplying a preliminary copy of their new map of the Liverpool Coast which has been plotted from air photographs taken by Dr. Lauge Koch. This has been incorporated with a few small alterations in the parts we traversed. The country to the west of Hurry Inlet has been filled in from compass surveys made by the author in 1933. All the soundings were taken from the *Pourquoi Pas?* and have kindly been supplied by Commandant A. Chatton.

The following new names have been added to the map and will appear in their Danish forms in the forthcoming Danish map of East Greenland: Kalkdalen (Limestone Valley), Ugleelv (Owl River), Moskusokseelv (Musk Ox River), Gaaseelv (Goose River), Falkeelv (Falcon River), and Hareelv (Hare River). In addition Roscoe Bjærge (Roscoe Mountains) and Emmanuel Glacier, which come only partly within the area of the present map, will appear on the forthcoming Danish map.

APPARENT MAGNITUDE IN NATURAL SCENERY

VAUGHAN CORNISH, D.SC.

I

IN the study of scenery it is difficult to act up to the motto that "science is measurement," for scenery is the pictorial impression of the outdoor world, a spontaneous effect, and direct measurement being conscious and critical impairs the spontaneity upon which the natural impression depends. For several years I tried to devise means of direct measurement which would entail a minimum of interference with the spontaneous impression, but met with little success. Subsequently I found an indirect method of measurement which is entirely free from this objection. For the last forty years I have always had a sketch-book with me in my travels at home and abroad in which I have made outline drawings of landscape. These drawings were made without measurement, for I never conformed to the custom of holding up the pencil and marking off distances, particularly the vertical spaces. Although done without measurement these drawings prove to be strictly comparable, panoramic views of distant mountains made in different years from the same standpoint being practically identical. It was my practice to delineate as much of the arc of the horizon as constituted the field of my conscious vision, which I may term the field of attention, filling the page of my sketch book, and on exceptional occasions the double page. The sketches were a sort of diary of travel; the view-point being known and the features identifiable on the map, the angles subtended can be measured; and by this means I have been able to compare the actual with the apparent visual magnitude by an indirect method which effectually defeats the critical faculty.

At Grindelwald I drew the outline of the Wetterhorn, 4 miles away, in the light of the summer dawn, and when the sun appeared above the crest put in the outline of its disc, which was 0·09 inch on a 7-inch page. At Bern I drew an outline of the Finsteraarhorn range, distant about 40 miles, in the winter dawn with the disc of the rising sun close to the Schreckhorn, and not far from the Wetterhorn which also came into the view. The diameter of the sun's disc was 0·16 inch on a 7-inch page. The linear enlargement of the latter was therefore 1·7, the area being increased 3·16 times, that is to say the difference between the apparent size of the rising sun at Grindelwald and Bern respectively was as great as the difference between the size of a sixpence and that of a half-crown. It is customary to explain such differences as due to the mental comparison of magnitude between the unvarying sun and the varying angle of a landscape feature viewed at different distances. Thus the common explanation of the above measurements would be that the apparent size of the Wetterhorn and Schreckhorn diminished in the same proportion as their distance increased and that the increase in the apparent size of the sun was inversely proportional to this change in the apparent magnitude of the mountains. In default of measurement this explanation would probably continue to command assent. The arc of the horizon comprised in the drawing made at Grindelwald was however 34°, that from Bern only 21°. Thus the diminution in the apparent magnitude of the mountains was much less than the increase of their

distance. The measurement of distances between several pairs of peaks conformed to the measurement of the whole width of the drawing. The ratio of the diameter of the sun in the two drawings, as already stated, was 0·16/0·9=1·7, that of the arcs of the terrestrial horizon was 34/21=1·6, which for this class of observation is practically identical. It follows therefore that the distant mountains were subjectively magnified to the same extent as the sun.

In general confirmation of this result I am able to cite the following evidence which does not depend upon the record, or even upon the observation, of form but upon an impression of movement. The season was January; I had just come down to Bern from Wengen, which is shut in by the great mountains of the Oberland. The weather had been brilliantly fine at Wengen and I had seen the daily passage of the sun across the Lauterbrunnen gorge. From Bern I now saw the sun passing low over the range of distant peaks, and was astonished at the speed with which it seemed to race along. I could not remember ever having seen the sun move nearly so fast. It is evident therefore that the inclusion of a relatively small arc of the horizon in the page of my sketch-book was not due to a habit of drawing but was a true interpretation of the fact that the arc of the horizon included in the effective field of spontaneous vision was much less in the wide plain bordered by distant peaks than where these peaks hemmed in the view.

I have made many drawings of the apparent size of the sun seen just above buildings and wholly or partly behind the foliage of trees. In the first the apparent size of the sun is small when the buildings are near, large when they are far away, but in the latter the sun is very large even when the tree-lattice is near at hand; larger even than when seen above mountain peaks 40 miles away. I infer that the explanation is that the forms with which the eye has to deal in the case of buildings are on a broad scale when these are near at hand but that as a tree is brought nearer to the eye so do the minute details of leaf and twig appear, thus keeping the field of effective vision small. It is, I think, significant that in my drawings of a huge sun setting behind trees not far away I have seldom filled the page of my sketch-book, which is my usual custom. As no thought was given to this matter at the time I infer that the field of my attention, that is to say of conscious vision, was then unusually small.

II

At the time when I first became familiar with the Bernese Oberland my home was on the verge of the cliffs between Bournemouth and Poole, at that time, the nineties of last century, a somewhat lonely place. The Oberland was my chief holiday resort and I became well accustomed to the skyline of Grindelwald and the Kleine Scheidegg. When I returned to my home overlooking the broad bay I was always impressed with the apparent width of the horizon, whether I looked at the long line of Purbeck Hills or at the Isle of Wight. It seemed obvious that the arc of the horizon embraced in the spontaneous view was much greater when looking across the open bay than when shut in by lofty mountain peaks, and I proposed the simple explanation that when the eye did not have to range vertically it was able to take in a wider angle horizontally (see this *Journal* for November 1926, p. 408).

When however I began measuring my impressionist sketches I found that

this explanation was the very reverse of the truth. Looking west from Boscombe Pier late one winter afternoon when long rolls of cloud lay above the dark band of the Purbeck Hills, the latter seemed to occupy so great an arc of the horizon that I used the double page of my sketch-book for their representation. A single page had seemed quite sufficient for a drawing of the Eiger and Mönch from the Kleine Scheidegg, which is near the foot of these lofty peaks. Years afterwards I measured these sketches and found that the arc of the horizon in the single-page view of the high, upstanding Mönch and Eiger was 60·5° and of the double-page drawing of the Purbeck Hills only 43·7°. I thought it desirable however to compare a panoramic view among the high mountains with the panoramic view of the relatively low coast-line. Looking through my Swiss sketch-books I found a double-page drawing of the Lauterbrunnen valley and its enclosing mountains taken from a recorded standpoint at Wengen. Measuring from the map, I found the arc of the horizon included in the double-page was no less than 109°. Thus when shut in by mountains the breadth of the field of conscious vision was more than twice as great as when looking across the open bay. I have measured a considerable number of drawings of Bournemouth Bay and the Oberland and all of them confirm this result. Thus whereas common sense suggested that when the eye did not have to range vertically it could embrace a larger horizontal angle, the measurements indicated that when the eye had to deal with the latter dimension only it was sooner satisfied. I suggest that in the impression of scenery the visual sense predisposes the mind, and that this circumstance often vitiates explanations reached by seeking backwards from our conscious thought for an appropriate intellectual origin.

After I had given up my home on Bournemouth Bay I spent more time in Switzerland. No longer keeping entirely to the upper valleys, as that of Grindelwald, I learned to enjoy the restful beauty of Lake Leman, staying at Montreux or Vevey in the winter or the spring. Here the mountains, ranging far to right and left beyond the long, level, and emphatic line of the opposing shore, added dignity to the prospect of the placid waters. In making my customary drawings of the line of mountain crests I used the double-page of my sketch-book, and for years supposed that my sketches comprised a much larger angle than that of the single page which usually sufficed for my outlines in the Oberland. When however I measured with the aid of the map the angles comprised in panoramic views from known standpoints I found that the impression of a broad arc was due, as on the sea coast, to the character of the lines, not to a large subtended angle. As one looks towards the head of the lake from the Quai Perdonnet at Vevey, the Rhone Valley beyond is flanked right and left by the impressive and conformable peaks of the Dents du Midi and Dents de Morcles. The waters of the lake, the northern and southern shores, these fellow mountains, and the peak of Mont Catogne as a central feature constitute a typically panoramic view. Yet the angle comprised in my double-page drawing of this view was only 26°.

The relation of the proportions of a landscape to the angle comprised in the view and to the apparent magnitude of its features is illustrated by the following measurements made at Cannes in December 1905. One afternoon I walked to the top of Le Pezou, where I often went to enjoy the double view of the bold

coast-line of the Riviera eastward to Italy for more than 30 miles, and westwards to the Esterels only 8 miles away and standing much higher in the picture. I saw the full moon rise above a far-off promontory of the Italian coast and almost simultaneously the sun set behind the loftier Esterels. The moon looked huge, the sun of only moderate size. This difference impressed me greatly, and I drew two rapid outlines of the coast to west and east with sun and moon in proper proportions to the adjacent features of the landscape (Figs. 1 and 2). When a quarter of a century later I measured these drawings in the 6·5-inch sketch-book I found that in the western view the diameter of the sun was 0·18 inch and the arc of horizon 26·3°, while in the eastern view the diameter of the moon was 0·35 inch and the arc of horizon 15·8°, giving a ratio of magnitude of 1 : 1·9 (diameters) and 1·7 : 1 (arcs). The diminution of the angle comprised in the horizon is the measure of the enlargement of the terrestrial features. Thus in the second drawing these objects were enlarged in nearly the same proportion as the moon.

In 1929 I set out on a voyage to Cape Town. As I had noted that the enlargement of the sun or moon was greater when the interval between skyline and sealine was small and when the luminary was nearly level, I supposed that the sun would appear very large when setting on the level where sea and sky meet in the mere line of the watery horizon. The weather was fine and I made drawings of the rising or setting sun, but it never looked very big. In only one case have I been able to measure the arc of the horizon comprised in a drawing made on this voyage, namely on a morning when the crescent moon and Venus were in the same view as the rising sun so that the scale could be learnt from the positions given in the Nautical Almanac. The sun's disc only occupied 0·2 inch on a 7-inch page, and the arc of the horizon comprised in the view was 35°, that is to say a much larger angle than in my drawing of the distant Italian coast from above Cannes or in a single page of my drawing of the coast-line of Bournemouth Bay.

The following observation appears to provide an explanation of this unexpected result. In March 1933 I was staying in Branksome Park near my old home on the cliff and went down one morning to the beach near Branksome Chine where the long line of the Purbeck Hills is seen across the waters of Poole Bay. It was a day of sunshine and colour, and the long band of the Purbeck Hills was less important to the view than usual, its chief function being that of a foil for the blue sky and drifting cumulus above and the blue and white of the dancing waves below. At this time I had given up using a lead pencil for sketching and taken to crayons, but still as a rule adhered to monochrome. On this morning however I had gone out into a world of colour, and a line drawing seemed futile. I therefore attempted a colour sketch in crayons. No thought of the geometry of scenery came into my mind. At a later date I measured from a large-scale map the arc of the horizon comprised in the single-page colour drawing and found that it was no less than 56°, more than double that of the drawings concerned with the form of the coast. Although my drawings from on board ship were not in colour yet my attention had been given to sky and sea, there being no intermediate band to attract the eye. Thus I infer that the angle of the view at sea was considerable because it was not restricted by the effect of a narrow horizontal band. Both these observa-

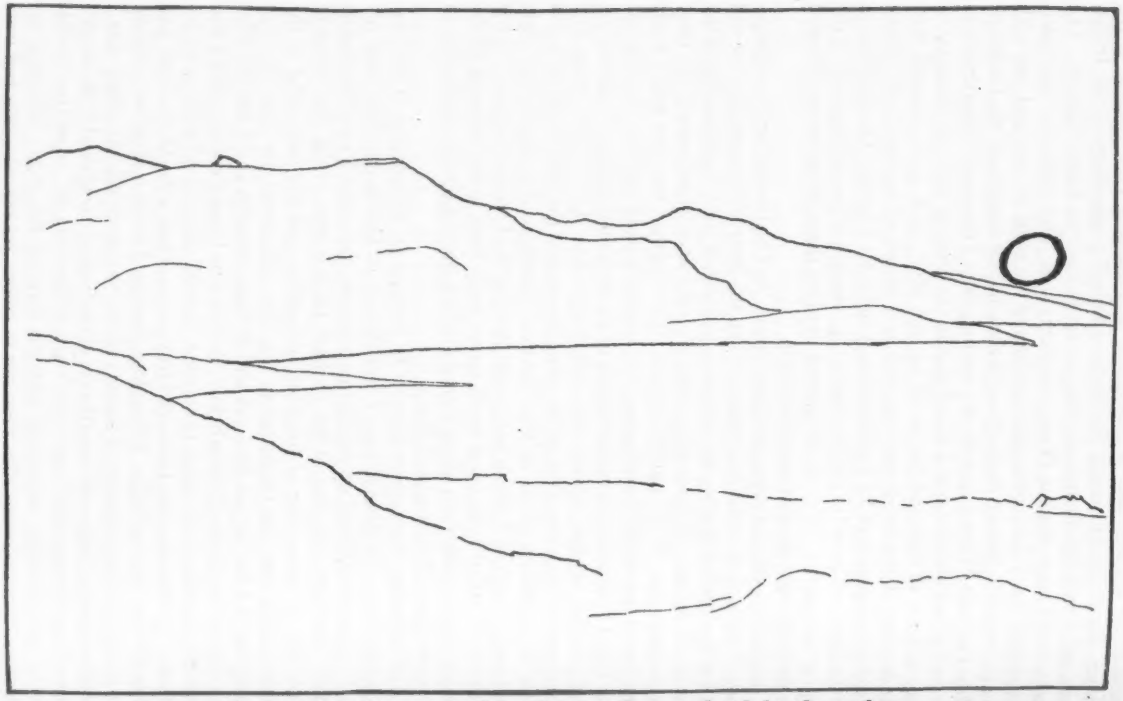


Fig. 1. The rising moon, from Cannes: from a sketch by the author

Fig. 1. The rising moon, from Cannes: from a sketch by the author

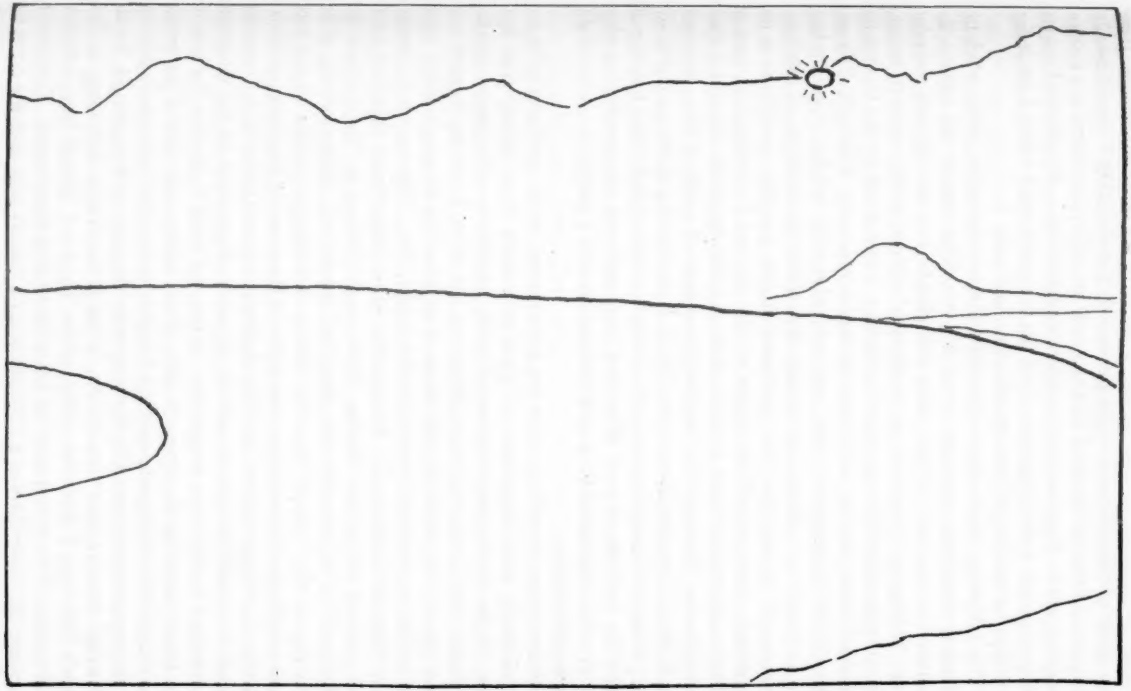


Fig. 2. The setting sun, from Cannes: from a sketch by the author

tions confirm the curious fact that the more the eye takes in vertically the more it takes in horizontally, and the less impressive are both dimensions. If one may speak of the eye as an organ possessed of personality I should describe this personality as of the kind that can only attend to one theme at a time but has great power of appreciating variations of the theme. By a theme I mean in this connection a visual category, and the categories with which I am dealing in this paper are height, breadth, distance, and area.

The following observation illustrates the overpowering effect which the principal magnitude exercises upon the eye. The season was autumn, the weather fine and still. There were few clouds, but the sky was somewhat hazy. Taking up a position on an elevated plateau with a western outlook, the common called Barossa near Camberley, I was struck by the fact that the sky-view centred on the sun seemed to have a huge area. The light of the sun, softened by the autumnal haze, was not unbearably bright. From the hazy sun as centre the brilliance of the sky diminished gradually in all directions. It occurred to me that this gradation might possibly contribute to the apparently great area of this region of the sky, and I remained on watch in order to ascertain at what altitude of the sun the apparent area would attain its maximum. At length the declining sun entered a belt of long, horizontal bands of thin cloud or dense haze. While I was looking at this part of the sky I experienced a mental shock, for I suddenly realized that I had forgotten all about the problem of area. What had happened was, apparently, that when my eye was confronted by length without breadth I forgot the existence of a second dimension.

Scarcely less remarkable than the enlargement of the level sun is the disappointingly small impression of giant mountains when viewed from their foot. As the eye becomes habituated to the conditions of the nearer view the apparent scale is to some extent increased, but when I cast my memory back forty years I can recall the full measure of miserable disappointment which awaited me on my first approach to the higher Alps. This was on the journey from Bern to Grindelwald. When I had gone rather more than half-way I was not sure for a time whether I was really looking at "the giants of the Oberland" or if some inferior range had interposed. Measurements of the drawings of the "giants" from the Kleine Scheidegg $2^{1}/_{4}$ miles off and from Bern nearly 40 miles away leave no doubt of the cause of this disappointment. On the nearer approach the arc of the skyline comprised in the field of conscious vision increased three-fold and the apparent dimensions of the mountains diminished in the same proportion. It was not until I climbed the slope of the lesser range on the opposite side of the valley and viewed the greater mountains with a steep-descending foreground that they once more came up to the expectation aroused by the view from the plain of Switzerland. I made drawings from various view-points. Thus at the Kleine Scheidegg on New Year's Day 1924 I drew the outline of the Eiger and Mönch from a distance of $2^{1}/_{4}$ miles. The view-point had not a descending foreground. The distance between the summits was 4·125 inches on a 7-inch page and the arc of the skyline comprised in the page was 60° 30′. Next day I took the train to Mürren. I looked back from a position on the brow of the Lauterbrunnen Gorge, 5 miles from the two peaks. Although I had more than doubled my

distance from the peaks their height was much more impressive. Measuring long afterwards I found that the interval between the peaks was 3·6 inches on the 7-inch page. The arc of the skyline included in the picture was only 27°.

If the apparent magnitude had diminished in proportion to increase of distance the width would have been only 1·85 inches and there was some foreshortening which would have made the width slightly less than this. Thus from the standpoint on the edge of the steep descent the linear scale was doubled and the field of view halved. From previous observations it is obvious that this enlargement is much too great to be accounted for by the increase of distance and is to be attributed mainly to the steeply descending foreground. The vertical angle of the picture, determined by measurement of heights and distances on the map, is 17°. I marked on the drawing the line which I judged from the map to be on the same level as the eye and I find the middle of the picture to be 6° 30′ above level. This, the upward tilt of the eye, was unaccompanied by any effort or muscular sensation.

I have given an account of the effect of the vertical narrowing of significant lines in making the coast view near Bournemouth appear of great width although the arc of the horizon embraced in the conscious view was not really large. The following observation relates to an apparent enhancement of the height of natural features consequent upon lateral restriction. I was at Caux above Montreux one December afternoon gazing across the Verraye gorge at the thousands of silver spires of snow-laden spruce which decked the long mountain-spur that projects from the Rochers de Naye to Chillon on the Lake. Then wreaths of mist, gathering upon the waters, came drifting up the gorge. Presently both the right and left extremities of the opposite mountain spur were blotted out. The middle portion of the frosted forest which remained visible now monopolized the attention of the eye. The change of scenic magnitude was however entirely different from that which might be reasonably expected from the change of physical magnitudes. As the mists encroached from right and left the silver spires in the clear gap grew taller (without distortion); the height of the whole tier increased most impressively; and the aesthetic appeal of the scene was enhanced by the increased sense of loftiness. The physical narrowing of the field of view was not accompanied by any sense of deprivation.

The following measurements of apparent magnitude of outdoor objects seen through a window have a bearing upon this experience. I had changed my bedroom, partly for the sake of a pleasant outlook upon pine trees which I could see as I lay in bed. The window-opening was 38 inches broad and 46 inches high. The angle subtended by this opening, which was not exactly opposite to me, was approximately 22° horizontally and 27° vertically. There was a rather broad division down the middle of the window, which was of the casement type, the right-hand half, that more nearly opposite to me, being made to open. At first it was my custom when called in the morning to have the curtains drawn back from both sides of the window, which gave me a view of a considerable number of pine trees. Later on however I found that I had a much more impressive view if only the right-hand curtain was drawn back, leaving an aperture of the same height, 27°, but only half the width, 11°. A group of three or four pine trees, with one of greater height than the others

not far from the centre, was now framed as a narrow upright picture. After several years' familiarity with these appearances I made drawings of the impression, without any previous measurement. On measuring the rapid drawings thus made I found that when seen through the narrow, upright aperture instead of a nearly square opening of the same height, the principal pine tree was increased one-and-threequarter times in apparent height, without distortion.

The following observation relates to the subjective magnification of objects when the aperture through which they were viewed was reduced in size without change of shape. At 9 a.m. on 6 August 1925 when the sky was almost free from cloud I made an outline drawing of the Jungfrau massif with its subordinate peaks the Grosse and Kleine Silberhorn. The distance between their two sharp pinnacles was 0·6 inch on the 7-inch page. At 11 a.m. white clouds had obscured the summit of the Jungfrau and framed the Silberhörner, which stood out sharply. I made a rapid sketch to record the impression. The distance between the peaks on this sketch was 0·8 inch, an increase of one-third. By noon the clouds had gathered more closely and the peak of the Grosse Silberhorn stood framed against the blue sky. A portion of this peak, which had a breadth in the first sketch of 0·4 inch and in the second of 0·5 inch, was now delineated with a breadth of 1·3 inches. As regards the aesthetic impression there was no doubt; it was entirely that of an enhanced splendour of magnitude. It should be noted that there was no physical reason why the field of conscious vision should have been restricted. The eye could easily have taken in a broad ring beyond the periphery of the cloud which now encroached upon the original view of the mountain. The explanation, as I understand the matter, is that the mountain, not the cloud, was the object of interest and attention so that the surrounding vapours became as the broad white mount of a small water-colour drawing, a suitable frame for isolating the object of attention. It should be borne in mind that the observer was fairly close to the clouds, which viewed from this standpoint showed no sharply defined convolutions except at the periphery.

I can again cite a relevant experience of views from a window. The room, small and long-shaped, with a window at one end, was formerly my bedroom. From the far end of the room, where was the head of the bed, a neighbouring house nearly filled the breadth of the window, and as this house was the object upon which I first looked out every morning, its apparent magnitude became strongly impressed upon my visual memory. The dressing-table was against the window and when standing there I noticed that the opposite house appeared much smaller than when seen from my bed. I then tried an experiment. Standing at the far end of the room I fixed my eyes firmly upon the opposite house and then walked slowly to the window. As I approached the window the opposite house steadily shrank in apparent size to about one-half, the enlargement of the window aperture remaining unnoticed. Then taking up successively three positions at different distances from the window I made rapid drawings of the opposite house. Measuring the breadth between two chimney-stacks on each of these drawings I obtained results which may be best expressed by saying that on approaching the window (from a distance of 12 to one of 1·25 feet) until the angle of the opening was enlarged nearly

five times (from 14° to 67° 30′) the apparent magnitude of outdoor objects was diminished to less than one-half (from 5·8 to 2·5 inches).

III

Text-books and encyclopaedias tell us that "the dip of the horizon is the angle through which the sea-horizon appears depressed in consequence of the elevation of the spectator" (*Chambers's Encyclopaedia*, article "Horizon"). The greatest height from which I have looked out over the sea is 3600 feet, the elevation of Mont Berceau, a limestone peak $2^{1}/_{4}$ miles from the shore of the east bay of Mentone. The dip of the horizon calculated from this height and allowing for the slight contrary effect of refraction is nearly 1°, not far short of two diameters of the sun. This is sufficient to appear important, especially when the sea horizon, as in this case, is at a distance of more than 70 statute miles. Nevertheless the sea horizon viewed from the summit of Mont Berceau did not "appear depressed in consequence of the elevation of the spectator" but on the contrary stood high above the middle of the picture. In astronomy the word "apparent" is used in an archaic sense. In what follows I employ the word "apparent" in the modern, literary sense. When returning to the Riviera shore from the heights which I ascended in my daily walks, the lowering of the apparent level of the sea horizon was not continuous during the descent, for whenever I came to a very steep downward slope of the path the horizon went up in the field of view, showing that steepness as well as elevation was a factor.

From Beachy Head with its moderate height of about 500 feet the horizon of the sea does not look as far away as when viewed from the summit of Mont Berceau, but there are positions on this precipitous headland where the horizon stands higher in the field of view. The effect is obviously due to the difference between a sheer cliff and the slope of a mountain side. The readiest explanation is that the steeper the descent the more the eye is lured below, so that the line to the middle point of the field of view is more and more inclined below to the horizontal direction. I knew from many observations that such an effect was produced upon the mode of outlook, but measurements subsequently showed that there was another unsuspected factor. I found two sketches from which direct measurement of the vertical angle comprised in the picture could be made with the aid of the map. One was horizontal, the other vertical, both taken from near the sharp turn in the cliff path from Eastbourne up Beachy Head where the lighthouse on the shore is directly in front. The drawings were made so near the edge of the cliff that at one point on the page the sea was at the bottom of the picture. The skyline was not far from the top of the picture. The vertical buttress of the chalk cliff on the right hand towered up impressively far above the line of sight, yet the sea-horizon was visible above it. I obtained the following concordant results from the two drawings: on the horizontal drawing the angle subtended by the sea was 8°, that by the sky 40′, and the total vertical angle in the field of view 8° 40′; while on the vertical sketch the corresponding angles were 7° 30′ (sea), 2° (sky), total 9° 30′. The concordant drawings show that the vertical angle comprised in the field of view was only about 9°. Thus the nearness of the skyline to the top of the field was only partly due to the depression of the line of sight, being

partly due to a magnification of the sea which is indicated by the great restriction of the field of view. A reasonable explanation of this magnification is provided by the well-known mental effect of standing on the verge of a precipitous height.

Further light was thrown upon this by an observation made during a walk on the cliff-top to the west of the summit of Beachy Head. A narrow projection of chalk rock, which one might term a natural corbel, juts out horizontally for several feet from the cliff, overhanging the sea. I made two drawings of the general view, the first from a standpoint where the corbel was a minor feature and the second close up to it. In the latter the vertical angle comprised in the picture was considerably less than in the former. The stereoscopic effect of the near-by corbel makes the sea look farther down, and the observer's view-point a giddy height. This would produce subjective magnification and its usual accompaniment, a reduced field of view. It is of much interest to compare the vertical angle of the view from a cliff with that from the shore-line. A sketch from the shore suitable for comparison with those from the cliff path on the ascent of Beachy Head was made from the marine parade at Sidmouth. The cliffs of Salcombe Hill, which provide the chief land feature of the eastward view, give the vertical scale. In this drawing the skyline of the sea is in the middle of the picture of which the total vertical angle, measured directly from the known height and distance of Salcombe cliff, is 18°. Thus the angle actually subtended by the sea viewed from the marine parade above the narrow shingle beach was about the same as that from the path by the edge of a lofty vertical cliff but the apparent angle was only about one-half as great.

IV

No feature of the landscape has a better background for clear display than the Skerry rock which rises from the sea beyond a lofty headland and stands silhouetted against the sky. From the cliffs between Bournemouth and Poole the rock called Old Harry stands out thus beyond Peveril Point. During the years when I had a house upon these cliffs the Skerry was always in view, and the hold which it took upon me as a landscape feature was demonstrated by the trivial but significant fact that I acquired the inveterate habit of making an outline drawing of Peveril Point and Old Harry Rock upon those fair white pages of blotting paper which are provided for the alleviation of committee meetings. The height of Old Harry Rock is 61 feet and its distance from Alum Chine 5 miles, so that from this position it subtends 8′ of arc, that is to say one-quarter the diameter of the sun or moon. From Bournemouth Pier the angle subtended is about 7′ 30″ of arc. From this point the rock is not silhouetted against the sky but seen against the background of a more distant headland. It is still however a picturesque feature and an attraction to the eye. The fact that this pillar of chalk rock is pictorial at a distance of more than 430 diameters I attribute to the circumstance that the form is of the utmost simplicity, dominated by one dimension. The following observation relates to a landscape feature almost as simple as a skerry, but *incised*. On a brilliant day in August 1933 I was taken unexpectedly to the top of Winsford Hill, one of the great view-points of Exmoor. I had not consulted the map, and excepting

the characteristic tors of Dartmoor the whole wide expanse was entirely strange to me. My attention was especially attracted by a notch in the southern horizon, a unique feature in the panorama. In ignorance of the topography I supposed that the southern skyline was some line of heights in mid-Devon, and it was with surprise that I presently noted that the notch had the characteristic profile of Sidmouth Gap, close to the south coast. On consulting the map it was at once evident that the notch was in fact Sidmouth Gap, the depression by which the railway reaches Sidmouth. I then quickly recognized several features of the south coast. It is evident therefore that the notch is a conspicuous feature at 30 miles, the distance of Winsford Hill. The depth of the notch is 450 feet, so that the object is 352 diameters away and therefore subtends rather less than 10′ of arc.

I now pass from the consideration of the greatest to that of the least distance at which certain features of natural scenery are pictorial. The massifs of scarped mountain ranges, such as the Alps and Andes, are among the most impressive and celebrated sights of natural scenery. They remain pictorial at the greatest distance at which atmospheric absorption permits them to stand out clearly, yet they dissolve from the view when we approach too near. I choose as examples the Eiger, Mönch, and Jungfrau. The massif of the Jungfrau arrests attention when seen across the plain of Switzerland from Bern, nearly 40 miles away. Its appearance at a distance of about 10 miles at the head of the Lauterbrunnen Valley may be said to have determined the situation of the Kursaal Gardens at Interlaken, the lay-out of the delightful Höheweg, and the situation of several huge hotels. Here the Jungfrau massif impresses itself very strongly upon the eye as a pyramid of pyramids. The neighbouring massifs have the same general character. It is well to make clear in passing that in this description the word "pyramid" is not used loosely as equivalent to "gable" but in the full three-dimensional sense, the salient edge being all important to the sense of mass.

At the Kleine Scheidegg the great triad, Eiger, Mönch, and Jungfrau, stands up near at hand. The Mönch rises 6700 feet above the Scheidegg and its summit stands 26° above the level of the eye. The symmetry of the group is so striking that there is a strong urge to view the three peaks together, yet in spite of this desire I repeatedly found that my attention had narrowed down to the pair Eiger–Mönch. The angle occupied by the triad was 100°, by the pair 60°. At other times my attention turned spontaneously from this pair and concentrated upon the Jungfrau, the largest member of the triad. Abutting on the right is the great block of the Schwarz Mönch, a form altogether inharmonious with the pointed summits of the Jungfrau and its subordinate peaks, the Silberhörner. I frequently found myself adopting some device to shut out the Schwarz Mönch from my field of view, simply owing to dislike of such incongruity and without realizing at the time any further significance of my action. On measuring the breadth occupied by the Jungfrau I found that it was 44°, so that, in a feature so high upstanding, this was evidently less than the spontaneous field of view. Thus at a horizontal arc of about 100° mountain features in the upper Alpine world disappear at the edge of the field in spite of the desire to include them, at 44° they intrude in spite of the desire to avoid them, but 60° is a satisfying breadth. As soon as we set foot upon the

Lower Grindelwald Glacier we leave the world of the passing continental tourist and enter that of the Alpine climber. Here the massif of the Eiger is no longer a feature in the view, the feature on the right hand of the gorge being the Hörnli, a constituent block of the Eiger. The very name of a massif vanishes from the local vocabulary except as the designation of the culminating peak which is the climber's ultimate objective.

It is natural that special attention should be bestowed upon the scenic character of distant views, but if we reflect upon our ordinary experience of landscape instead of allowing our minds to dwell upon exceptional prospects we shall realize that some part of the surrounding skyline is usually not more than 100 or 200 yards away, frequently a line of tree-tops. Where the undulations of the ground are steep but not lofty, as in the New Red Sandstone of Worcestershire, the raised brow of the open field is often at this moderate distance so that the figures of the horse and his rider, or of the ploughman and his team, are outlined against the sky at an effective distance. For these restricted but picturesque landscapes the hand camera with a medium-angle lens has a satisfactory field of view. The film of the quarter-plate Kodak with which the landscapes in my book on 'The Scenery of England' were taken, comprises an angle of $42° \times 33°$. This film in the upright position is sufficient but not unduly large for the view of a tree from the nearest point where the symmetry of form can be properly appreciated. When however we attempt to deal photographically with a view in which the interest lies in the neighbourhood of the distant horizon of a plain viewed from a hilltop, the ordinary camera lens ceases to be satisfactory, for it not only embraces more of the horizon than the eye compasses in such a landscape but a large angle of foreground unnoticed by the observer obtrudes in the photographic picture. This brings us to the important subject of the distance of the ground-line in the natural view. The term "ground-line," used in text-books on drawing to designate the base of the picture, may conveniently be applied in the demarcation of the natural scene. It happens that a small area around our standpoint, "the ground at our feet," is of capital importance to the nature-lover, for it is the radius within which he can fully appreciate the combination of symmetry and colour in which the flowers of the field excel all the large features of scenery. There are times when this miniature landscape absorbs our attention to the exclusion of the wider view. When we are seated upon the ground it often happens that the head inclines so as to limit the view to a radius of some 30 feet. When we rest among the heather when the blossom is out and the humble bee goes droning by and butterflies flit from flower to flower, this little landscape of flowers and insects and their related life fills the view and satisfies the mind. With an eye-height when walking of 5 feet 3 inches the 30-foot ground-line is 10° below the horizon. A hand camera with the moderate angle of 33° vertically (for the long picture) if held level brings the ground-line 16° 30′ below the horizon, which, for the same height, would be a distance of only 18 feet. It is not only on account of its angle below the level that the 30-foot ground-line is outside the ordinary landscape view. If an object, as for instance a spray of leaves on a hanging bough, cross the line of sight at that distance it cannot be focused simultaneously with distant objects.

Let us now compare the conditions of visibility in the radius of 30° round the zenith and 80° round the nadir. When we are standing or walking we cannot see the stars which are above 60° or thereabouts unless we bend the neck uncomfortably. If however we adopt a recumbent position, the circle of 30° radius surrounding the zenith becomes an integral part of the wider view, whereas the restriction imposed by focusing prevents the 80° at the nadir from being so included. From the proportions between a circular disc and the enclosing ring it is easy to calculate that the ground at one's feet, meaning all within a 30-foot radius, subtends visually more than three-quarters of the terrestrial half of the natural scene. When attention is fixed upon a distant horizon the ground-line of the natural field of view is generally so far away that human figures and those of the larger quadrupeds are not important in the landscape. Nevertheless birds in flight, although usually smaller objects, are often a notable feature in the wider view. The symmetry of the bird in flight being bi-lateral we can estimate the maximum distance at which it would be pictorial. I have shown that a very slender pillar of chalk rock standing up against the sky is pictorial when subtending an angle of 8′. If a bird in flight had a visual diameter of 16′ its symmetry would be displayed, and so it would be pictorial. Incidentally, it is easy to realize that if the Earth had a second satellite of only half the diameter of the moon the crescent of 16′ with its two horns would be a striking object.

Birds in flight look big when seen above the horizon and backed by clouds on account of the exaggerated impression of distance resulting from their position. It happens that there is one extensive view well known to millions of people in which seagulls in flight commonly form a notable feature. I refer to the reaches of the London Thames from Westminster to Fulham. The gull soaring above, and some considerable architectural feature on the skyline are often visualized together and appear of comparable magnitude. The circumstance that smoke makes the air overhead hazy contributes to the apparent distance of the wheeling seagull. When the bird swoops down it is often surprising to note how near are the buildings which form its background before it touches the water.

V

Two problems of scenic magnitude have chiefly attracted the attention of the general public, the enlargement of the level sun and the mountainous appearance of storm waves at sea. But whereas every one agrees that the sun sometimes seems huge when near the horizon, the idea that ocean waves ever look as high as mountains is now discredited. In the course of many voyages I have made special observations of both the real and apparent magnitude of waves on the Atlantic, Pacific, and Mediterranean. During strong gales, force 9 of Admiral Beaufort's scale, I measured the actual height of the North Atlantic waves [1] and found that many individual waves attained 30 feet from trough to crest and a few exceeded 40 feet. I found that the apparent height of waves in rough weather suddenly became imposing when those near at hand topped the horizon. The whole appearance of the sea-scape then imme-

[1] The method of measurement is explained in my book on 'Ocean Waves and Kindred Geophysical Phenomena' (Cambridge Univ. Press 1934).

diately changed. On the modern liner, with its great length and lofty decks, this sudden mounting of the waves is a comparatively rare sight. In the days of sailing ships when the length of the vessel was less than the interval between storm waves and the height of the deck less than the height of the waves, it was the common experience of every storm for the voyager to find himself surrounded by topping seas.

During one of the strong gales in the North Atlantic when we were surrounded by a welter of topping seas a scud of rain came on which obliterated all minor detail and imparted distance to the horizon. I was then irresistibly reminded of a landscape on the Berkshire Downs of which I always carried a clear picture in my mind's eye, for I had shot over the ground for a number of years. The view is from the Ridgeway near Sparsholt Copse looking across the Lambourn Valley. Here the general height of the undulations of the chalk is about 300 feet and the proportion of their crest-length to the interval between ridges is comparable to that obtaining among the waves in an Atlantic storm. Thus when during a strong gale the ship was surrounded by a horizon of moving mounds, and minor detail was obliterated by driving rain, the impression, as distinguished from estimation, of magnitude was equal to that of hills of ten times their linear magnitude.

I have never seen waves at sea appear as high as the 3000-foot mountains of the Lake District or Snowdonia, nor even approach the scale of the high Alps. It is clear therefore that the phrase "as high as mountains" conveys an exaggerated impression of the appearance in a storm. The explanation of this discrepancy is not however to be found in any propensity for exaggeration but in a historic change in the connotation of the word mountain. The term "mountainous" as descriptive of rough seas was in use in the seventeenth century, if not earlier. In the eighteenth century the Sussex Downs, rising to 800 feet, are "majestic mountains" for Gilbert White. Early in the nineteenth century Salcombe Hill and Peak Hill, rising rather above 500 feet on either side of Sid Vale, are the "long and lofty mountains" of the Reverend Edmund Butcher, who wrote the first guide-book to Sidmouth. I think that there can be no question that the introduction of the sport of Alpine climbing which became popular with Englishmen by the middle of the nineteenth century, raised our standard of the "mountainous." The Malvern Range rises to 1400 feet, but we speak of the Malvern Hills. 2000 feet is about the line of demarcation between hill and mountain in Great Britain according to the custom of to-day; Ingleborough and Pennyghent, for instance, both about 2300 feet, are classed as "the mountainous outliers of the millstone Grit."[1] Thus the term "mountainous waves" now suggests a hundredfold enhancement of apparent magnitude, whereas the apparent enhancement is actually about tenfold. In the United States the change of usage in "mountain" and "mountainous" is less marked than among English people. When I visited the Isthmus of Panama during the construction of the Canal I noticed that American tourists commonly referred to Gold Hill, the central eminence at Culebra, less than 700 feet in height, as a mountain.

[1] See Horace B. Woodward, F.R.S., in the letterpress of 'Stanford's Geological Atlas of Great Britain and Ireland.'

THE DISASTER ON NANGA PARBAT

IN the great tragedy of Nanga Parbat in 1934 four German climbers and six of the finest Sherpa porters lost their lives; and the sympathetic concern of all Himalayan travellers was heightened by subsequent rumours of dissensions between the Europeans and the porters, of indifference to the fate of the latter, and of inadequate provision for their families. It is therefore a great satisfaction to know that a British officer of unsurpassed experience and authority in these matters, recently in Darjeeling, has spoken with the surviving porters, has found them absolutely satisfied with their treatment, perfectly ready to follow again the surviving climbers of the Nanga Parbat expedition, and quite undaunted by the catastrophe, while all proper provision has been made for the families of those who were lost. General Bruce's statement is confirmed by an official letter from the Himalayan Club addressed to the Alpine Club.

In a recently published book: 'Deutsche am Nanga Parbat: Der Angriff 1934,' Herr Fritz Bechtold gives the full story of the disaster; and we are indebted to Colonel E. L. Strutt, President of the Alpine Club, for the following account of this work:

Dedicated to the memory of the four Europeans and six natives who perished on the mountain, this is the narrative of the greatest of Himalayan tragedies. A miserable story of anticipated victory, of frustrated hopes, of final and complete disaster; of courage, of devotion, though of errors of judgment and leading if you will. In the manner of his telling, in the simplicity of his style, in his loyalty to comrades, Austro-German and Himalayan, Herr Bechtold has gained the respect and sympathy of every mountaineer. His book disposes effectively of those vicious rumours of indifference to the porters, emanating from anti-British sources in Kashmir, I believe, or possibly from the same mischief-maker who caused a strike among the Baltis by asserting that the Darjeeling men were receiving 5 rupees a day. From beginning to end of the expedition it is plain that Europeans and natives were in the best possible relation. The story is one long tribute to the thirty-five Darjeeling men and, reading between the lines, we realize mutual trust, mutual affection. The powers of the Sherpas and Bhotias have long been known, but still better is it to find well-deserved praise for the Balti men. It was, of course, impossible to fit out all these latter for really great heights; nevertheless some of the men carried 5000 feet and more of very steep and difficult glacier to Camp IV, at 19,000 feet, as often as thirty to thirty-two times.

At the start of the expedition all appears to have gone well. Conditions, weather, progress: all were satisfactory up to June 7, when Herr Drexel sickened and quickly died of pneumonia. This sad event, together with the non-arrival of the porters' rations, considerably delayed the assault. It was not till nearly a month later that Camp V (6600 m.) could be established, whence K_2 and the Muztagh Tower in the far Karakoram are stated to be visible. The Rakhiot peak was circumvented by a difficult and exposed rocky traverse, rendered safe by the fixing of nearly 500 feet of rope. This place is stated to be the extreme limit of difficulty for laden porters. The acclimatization of the party appears to have been very slow. From Camp VII, where

complaints of breathlessness among the Europeans were frequent, Herr Bechtold was obliged to descend with two porters suffering from mountain-sickness. He experienced great difficulty in bringing down the two completely exhausted men, but a fine performance resulted in all three, despite a storm, attaining Camp IV. To this enforced retreat the author and his companions doubtless owe their lives. Bechtold was under orders to ration the tents above him in readiness for the return of the victorious summit party, which, reduced from nineteen to the almost equally unwieldy number of sixteen, had meanwhile pushed on, the head of the column attaining a height of well over 25,000 feet before returning to Camp VIII, slightly lower down. The storm and its subsequent results are well known; the story makes painful reading. Herr Schneider's account has been published in the *Alpine Journal*, vol. 46, pp. 423–27, and I translate Herr Aschenbrenner's narrative (pp. 55–6):

". . . The dawn of July 8th brought in fact no improvement. A longer sojourn in the tents [these appear to have been very bad] became almost unbearable, while further advance towards the summit was quite senseless. At 8 a.m. Wieland came to our tent. We were all agreed that the first assault was defeated and nothing was left but retreat to Camp IV. This was a sad decision in view of the peak's proximity, but when the order came that Schneider and I were to proceed to break the trail with three porters, we prepared for the descent. We had the greatest difficulty in arousing the porters from their warm sleeping-sacks to face the howling storm. While I roped up the porters, Schneider decided with the others what should be left behind for the next attack. No one complained of any sickness: we were all in good condition. At the time of our departure Merkl, Welzenbach, and Wieland were already equipped for the descent and we were positive that they would follow at once. On attaining the *Silbersattel* the storm increased so much that we could descend the steep slopes only with the greatest precautions. Pinzo Nurbu and Nima Dorji were going very badly, while Pasang was in his best form. We had with us two sleeping-sacks, one for the porters and one for ourselves. Schneider was leading, the porters were in the middle, while I was last man, ready at any moment to check a slip. About 100 m. below the gap Nima Dorji was hurled by the storm from his steps and only with the greatest difficulty could Pasang and I hold him and thus avoid certain disaster to all. But the storm had torn the sleeping-sack from his shoulders; before our eyes the great mass sailed away like a balloon over the Rupal slope. We five men were left with but one sleeping-sack. Consequently it was of vital necessity to attain Camp V or Camp IV on the same day, if we wished to avoid death from freezing. In the raging blizzard we could not see 10 metres in any direction, and of course went frequently astray. To avoid these wanderings, fatiguing for the porters, we unroped over the not difficult terrain near Camp VII. On one occasion as the storm for a moment tore asunder the clouds, we perceived the second party coming down over the *Silbersattel*.

"In Camp VII the abandoned tent was still standing. On the way to Camp VI great lassitude overcame me. Every 30 metres I was compelled to sit and rest on the snow for a space. The snow particles were driven like red-hot needles against our burning faces. Our porters had vanished from

the zone of vision, but we surmised they were close behind. In any case they would be collected by the following party. In Camp VI the abandoned tent was deeply snowed in. In the complete lack of visibility, we considered it better to climb *over* the Rakhiot peak and not to turn it, although this entailed an ascent of 150 m. I had recovered again, but Schneider was overtaken by the same fatigue that I had now overcome. The descent over the steep exposed rocks of the Rakhiot north ridge put him to rights again. Lower down by the fixed ropes we descended quickly to Camp V. In the tents we found certain high-altitude rations besides sleeping-sacks. We ate heartily and recovered so well that we decided to descend to Camp IV. We arrived there late in the afternoon, joyfully received by Bechtold, Bernard and Müllritter. At last we were in safety, as if in an Alpine shelter-hut."

The party waited but no one arrived. The *Sirdar*, Lewa, was summoned next morning to a conference, but in the storm neither Europeans nor porters could do anything. At 11 a.m. to the dismay of all ranks a momentary clearing showed a large party descending but still no further on than the *Silbersattel;* disaster was imminent. The storm continued, snowing up the tents so that egress became almost impossible. In the afternoon of July 10, seven or eight persons were perceived descending the ice slopes of the Rakhiot peak, leaving an enormous furrow behind them. Finally the rescue party met but four porters, so exhausted that one of them plunged helplessly over a sérac wall. They were conveyed to the tents by the inexhaustible but dreadfully overworked Dr. Bernard.

And so the lamentable story continues: ceaseless efforts to ascend, endless defeats in bottomless masses of fresh and driven snow. A porter is found lying dead in the snow near Camp V, two more can be perceived dead among the ropes of the Rakhiot peak. Survivors and rescue party see nothing left save to abandon Camp IV on July 13. On that day however comes the last sensation. Three figures can be seen staggering down the ridge below Camp VII, the storm wafts faintly cries for help; there is yet another vain effort at rescue. Finally in the evening of July 14, frost-bitten and starving, from the very jaws of death, comes Angtsering the superman. He relates the end of Wieland and Welzenbach, the certain fate of Merkl the gallant leader, the last to perish in the post of honour, the extreme rearguard, together with the porter Gay Lay. Perhaps "the latter might have saved himself on July 14th with Angtsering, but remained with his Sahib-leader, faithful unto death" (p. 61). The last desperate but useless attempts were made on July 15, 16, and 17 by Schneider, Aschenbrenner, Raechl, and Misch; their efforts penetrated no farther than Camp V. But cries for help could still be heard on the ridge on July 16, though the waving figure, seen earlier above, had vanished. Camp IV was then evacuated, the sick and wounded porters were led or carried down by the Baltis under Lewa. Nurbu, Sonam, and Ramona the expedition cook were the last to leave.

THE ROUTE TO THE RUPUNUNI SAVANNA

GEOFFREY DAVIDSON

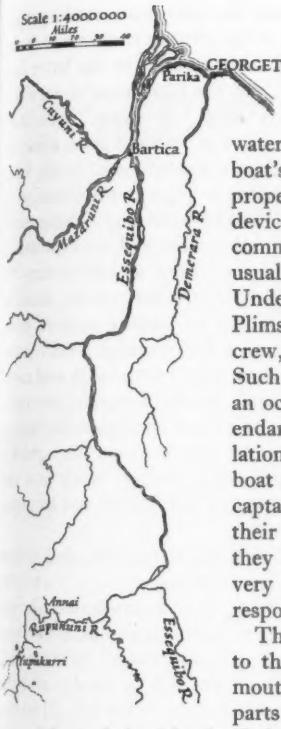
THE TIMES for 29 September 1934 gave some details of a proposal to settle Assyrians from 'Iraq in the Rupununi District of British Guiana. Up to the present time the savanna country, with which the settlement scheme deals, has not been productive. There is no cultivation beyond what is required for the needs of the ranchers and native Indians who inhabit the area. That a large part of the savannas could probably be cultivated there is little question, and it is doubtless due to the lack of suitable communication with the coast that nothing has yet been done. The scheme for settlement of the Assyrians however might suggest a very different prospect for this part of British Guiana; but a vast amount of work, entailing the expenditure of large sums of money, would have to be performed to provide for better communication. Furthermore, the League of Nations Commission appointed to examine the district is confronted with serious problems: large portions of the area are at certain times flooded, not only by the Rupununi River itself, but by many creeks, and become quite uninhabitable; conversely, large areas suffer acutely through lack of water at other times in the year. How much really habitable land can be found in the district and for how many people is a difficult question and one which demands a close scrutiny of the area and much information not only perhaps from the local Government officials but also from residents of many years' standing in the district.

There are two means of access to the district. One is the journey by land along the cattle trail, a not very pleasant walk or ride of a fortnight or more, a large part of which runs through dense forest. The trail is maintained, but in rainy seasons suffers in parts from swollen creeks, and it is not the custom to drive cattle from the savannas to the coast during certain months of rain. The other approach is by the more exciting but less arduous river route. Leaving Georgetown, the capital, we are conducted by ferry steamer across the mouth of the Demerara river, thence by train to Parika on the Essequibo River; from this point a Government steamer conveys us to Bartica, distant a few hours up the Essequibo River. This little town lies on the left or western bank of the Essequibo, where this and the rivers Mazaruni and Cuyuni converge. Bartica is the starting point for all those who go by boat to the diamond and gold fields of the Mazaruni and Cuyuni rivers respectively and to the Rupununi District; and here begins the real river journey. The boats, of special construction for their better handling and navigation up and down rapids and falls, are almost all driven by inboard or outboard engines and can carry loads of up to about 14,000 lb. Larger boats have been constructed but have proved to be rather unwieldy for man-handling in the falls, though they may provide a feeling of greater security in rough water. When one realizes the tremendous wear and tear which these boats are called upon to stand in being hauled up or lowered down falls and, as happens quite often, in accidental bumping and riding over rocks while travelling at speed, it is not surprising that they should be built of the toughest timber, the keel boards being of the famous greenheart wood. Special precautions are necessary to safeguard the propeller

Loading at Bartica

Approaching a fall in the Essequibo river

Hauling up a heavy boat at Gold Falls, an awkward point in the Essequibo river. Part of the first boat can be seen at rest in the foreground while its crew drop back to help the second



Hauling up a heavy boat at Gold Falls, an awkward point in the Essequibo river. Part of the first boat can be seen at rest in the foreground while its crew drop back to help the second

under such conditions: in the case of the outboard engine of course the motorman can quickly tip the engine forwards and downwards and the propeller is lifted clear out of the water at the first sound of anything striking the boat's keel. In the case of inboard engines the propeller is fitted as a rule with a guard and lifting device, the latter being operated, on the word of command of the captain, or steersman as he is usually called, by a man stationed in the stern. Under Government regulations every boat has its Plimsoll line, no deeper draught, with full cargo, crew, and passengers (if any), being permitted. Such a regulation is very necessary to prevent an occasional inclination to overload boats, thus endangering cargo and lives. There are also regulations governing the number of the crew of each boat according to its capacity. Furthermore, the captain (steersman) and bowman must have gained their certificates for navigation in whatever river they propose to operate, for their work is of a very skilful and intricate nature and of great responsibility.

The Essequibo River, up which our journey to the Rupununi District takes us as far as the mouth of the Rupununi River itself, is in many parts of great breadth and is often split up into many channels by islands. It is the task of the steersman to choose without hesitation those channels which provide for the easiest and safest navigation of his boat, especially at the many points where rapids and falls have to be negotiated. When it is realized that a rise or fall of a few inches in the river makes all the difference in the world to the falls, rendering some of the channels too shallow and others too fierce in their volume of water, or the actual drop of a fall in some channels too high, while others become more navigable, it is clear that the steersman must be thoroughly acquainted with every passage at each of the falls and at every different state of the river. He must have, in effect, a fairly thorough knowledge of the bed of the river, which in the vicinity of falls or rapids is just one mass of rocks, or, as the boathands say, "rockstones." Not only the steersman but the bowsman also requires and does possess a wonderful knowledge of how to read the water, by which is meant that they can see ahead by the action of the water where danger lurks in the form of submerged rocks, sucks, or whirlpools.

A boat of average capacity will carry as crew steersman, assistant steersman, sometimes called "awkward paddle," bowman, motorman, and approximately sixteen or eighteen boathands. Apart from engine, etc., the equipment includes steering paddles for the two steersmen, bow paddle and paddles for all boathands, while the following ropes are required: the wapp, of considerable

length for straight hauling, the bow brace and the stern line, not forgetting a life line. The bow brace and stern line are of the greatest importance in the negotiation of falls in travelling both up and down stream; in the latter case because it is often impossible to "run" a fall and the boat must be carefully lowered backwards by the ropes, an operation called "streaking." The chief use for these two ropes is in keeping control over the bow and stern when, in the process of the work in the falls, they are frequently subjected to the force of a torrent of water rushing through a channel at an angle to the direction in which the boat is being hauled or lowered. Naturally the wapp alone could never, in such water, hold mastery over these side rushes, and the boat would easily be swept round broadside to the torrent, heel over, and in no time fill and be lost. Nearly all the falls and rapids have been given names, some of which are associated with unfortunate accidents or narrow escapes from disaster. In spite of the hazardous conditions of the journey however the extraordinarily small loss of life or boats speaks highly for the skill and carefulness of the captains. The work of the boathands, in which captain, bowman, and all join, is often very dangerous, giving the passenger an unpleasant feeling of anxiety. A mistake or inattention to orders by any one man may quickly end in disaster. The men well know the seriousness of their work and the risks they are called upon to face, yet they do it with a will, joking and laughing the while.

Less than one day's run from Bartica the first fall is reached, and before arriving at the mouth of the Rupununi River anything up to a fortnight, perhaps longer, if the rivers are particularly dry, may have elapsed, during which time the men have worked in the water at falls and rapids for several hours each day with spells of rest when travelling in still water. At some falls it is found necessary to unload the boats either partially or totally and the cargo must be carried by the crew over rocks to a point above the fall, an operation known as "portaging," and there reloaded in to the boat when this has been hauled up. At other falls it is found possible to "steam" them; this requires skill and strength on the part of the steersman and bowman in controlling the direction of the boat and, on occasions, a long and hard spell of fast paddling by the crew to assist the engine, which is itself running at full speed. This is especially the case as the boat comes to the actual "bump," which is the name given by the boathands to the actual lip of the fall. Here crew and passengers have all the excitement, and more, of taking part in a gruelling and close finish to a boat race, but, in this instance, they are up against a much more serious problem. Theirs is an unmerciful enemy, an all-powerful torrent of water rushing against them, doing its utmost to turn and twist their boat and sweep it aside. For minutes, in spite of the united efforts of engine and paddles, the boat may not make the slightest headway, then, in some mysterious way, the steersman has made use of slight variations in the rush of water and, by watching some stationary object, we see that we are creeping up an inch at a time. So the fight goes on until the boat is well over and clear of the bump. A great feeling of triumph over a powerful element; but nature sometimes refuses to be conquered, for, no matter how engine and crew may strive, they may be forced to give in, and have to drop back to a point from which to start hauling.

Portage at Habakuya Falls, Essequibo river

Very low water in the Rupununi river a few miles below Wichabai

Whether we are to face further falls in the Rupununi River now depends upon the point which it is desired to reach in the savanna country. Throughout our whole journey in the Essequibo River and for a further considerable distance in the Rupununi we have been walled in by dense forest on both banks, and each evening we have had to camp in a little clearing in the bush at the water-side. The worst of our troubles have been left behind: or perhaps it might better be said that the worst of those which keep one's nerves in a state of high tension are finished with. For, in the Rupununi, if we choose to do our journey in the drier months of the year, there may be so little water that we very soon find ourselves searching for a course among sandbanks. Progress may be very slow, the crew frequently being called upon to jump overboard to assist the boat through these banks. Under such conditions it is unwise to try to make use of the engine and so paddles and "polesticks" (*i.e.* punt-poles) come into use. If the river is full progress, though restful, is still not very rapid owing to the strong opposing current.

After about two days' steaming up-river we at last obtain our first view of open country, and what a pleasure it is and what a desire is felt to disembark and stretch one's legs. This can be done provided the river is not in flood. We come shortly to Annai landing, from which a short walk across the open will take us to Annai village; from this landing-place onwards up-river are others at varying intervals, such as Karinambu and Yupukari; beyond the latter it is unwise to proceed unless there is plenty of water. Boats *can* go several days' journey farther through the heart of the Rupununi savannas, but the right time must be chosen, otherwise boats may become stranded, unable to return until a rise in the river, which, with alternatively rain and fine weather in its upper reaches, fills and empties very rapidly. Furthermore beyond Yupukari there are once again falls to be dealt with, though to a lesser degree than in the Essequibo River, and, together with little water and shallows strewn with fallen trees, they render further navigation in anything larger and heavier than canoes a tiresome business.

Given good conditions, *i.e.* high water, the journey by river to the Rupununi savanna country may be accomplished in a fortnight; in low water anything up to double that time may be taken. The distance, as the crow flies, is approximately 200 miles to Yupukari.

Very low water in the Rupununi river a few miles below Wichabai

ANTARCTIC NOTES

J. M. SCOTT

THE first season's work of Admiral Byrd's Antarctic expedition was covered in the August and September numbers of this *Journal*, but it will be convenient to restate it briefly before describing what has been achieved since then. The most laborious work was the re-establishment of Little America, for it involved the transport of 500 tons of stores over 6 miles of the Barrier ice. Both expedition ships, the steel *Jacob Rupert* and the wooden *Bear of Oakland*, made voyages eastward to about the 150th West Meridian in South Latitudes 60° 45′ and 73° respectively. They saw no signs of an archipelago stretching northward from the coast of King Edward VII Land, such as they had thought might possibly exist. Finally a weather station hut was erected 123 miles south of Little America and Admiral Byrd occupied it alone at the end of March.

The winter routine of the fifty-six men at Little America was interrupted by the necessity of relieving their leader. Following Admiral Byrd's first wireless request for help on July 20 Dr. Poulter, who had been left in charge of the Base, made three most courageous journeys by tractor, the third of which was successful. Motor tractors have never before proved entirely successful in the Antarctic, but by these emergency journeys they entirely justified their use. Under such appalling conditions of cold and darkness both dog teams and aeroplanes would have been helpless. The only possible alternative would have been a man-hauling party after the style of the extremely exhausting winter visit to the penguin rookery by Wilson, Bowers, and Cherry Garrard of Captain Scott's last expedition. But these tractors with their square cabins, folding bunks, and cooking apparatus allowed the men to reach their objective in excellent condition. Admiral Byrd however was by no means well, and it was not till October 13 that he could return to Little America.

By that time the second season's work had already begun, but before describing it let us remind ourselves of the geography. The Ross Ice Barrier hangs from the Polar Plateau like an inverted horseshoe 400 miles long. Admiral Byrd is interested in its eastern arm, and Little America is near its north-eastern extremity, King Edward VII Land. South and east from there is the Edsel Ford Range with Marie Byrd Land beyond, both discovered on the former expedition. Then, still going southwards, comes a gap beyond which rises the Queen Maud Range, pierced here and there by steep glaciers running down from the Polar Plateau. In the gap between this range and the subsequently discovered Marie Byrd Land, Amundsen placed Carmen Land. But the first Byrd Expedition convinced themselves that Carmen Land did not exist. In its place, it seemed, there might be the debouchment of a channel flowing right across Antarctica from the Weddell Sea.

On November 15, while the sledging parties were in the field, Admiral Byrd made a flight to settle this question. South of Marie Byrd Land he saw a definite depression and with his altimeter judged its surface to be no more than 400 feet above sea-level. So the channel, he concluded, probably existed.

Chief Pilot June then made a flight which seemed to confirm this hypothesis, though it was certain that the channel must be a narrow one, for he saw that an extensive plateau rose only a few miles south-westward of the depression. But "this plateau," wrote Admiral Byrd, "died out in the vicinity of the 81st parallel and gave way to a water-borne barrier, or in all events to ice, the bottom of which rested on land below sea-level." Finally, on November 23, Admiral Byrd followed this ice eastward from the depression. But when he turned in longitude 140° west its surface had risen to 1325 feet above sea-level.

Throughout this season several long sledge journeys were in progress, but although they may be considered as the backbone of the scientific work they can only be mentioned briefly here, for full details are not yet available. The first reported "the discovery of an extensive ice-ridden plateau situated between the Rockefeller Mountains and King Edward VII Land and the Edsel Ford Range and rising unbrokenly to the south." The second and most substantial journey was led by Mr. Blackburn who took his dog sledge party 100 miles up the Thorne glacier in the Queen Maud Range. There they found plant fossils and beds of coal. Mr. Siple, who led a branch party eastwards, brought back specimens of moss, lichens, and microscopic life from Marie Byrd Land; and Mr. Wade is reported to have made interesting geological discoveries in the same region. The tractors, which had been so useful in the winter, were unable to negotiate the bad crevasses at the head of the Ross Ice Barrier, but they were used for depot laying and they carried seismographic equipment to Marie Byrd Land and the Edsel Ford Range. All these parties carried wireless sets and maintained a regular schedule with Little America. This second season was well filled, but it was not a long one. In the New Year the party at Little America were packing up and on February 6 they were all on board their two ships. In their haste to escape the ice they left two tractors and minor pieces of equipment behind. The 1930 expedition sailed for home on February 19.

There is little to tell about Mr. Lincoln Ellsworth for his sole objective is to fly across the Antarctic Continent from the Weddell to the Ross Sea, and in this unfortunately he has again been unsuccessful. The *Wyatt Earp* took him south very early in the season. He reached Deception Island before the end of October: his machine was taken ashore and assembled; but as soon as the engine was started a connecting rod snapped. This was the one spare part that was not carried, so the *Wyatt Earp* had to make a trip to Megallanes, Chile, to get another connecting rod. At the end of November, when the machine was repaired, Mr. Ellsworth decided that he could not make the flight on skis from Deception Island; so he loaded his plane, fully rigged, on board the *Wyatt Earp* and sailed south to look for a suitable take-off. The next news was most spectacular. Soon after Christmas it was reported from New Zealand that Mr. Ellsworth had successfully made his flight across the Antarctic to the Ross Sea. The report was most emphatic though lacking in any details as to times, course, and the exact position of the take-off and landing. Next day it was contradicted. Actually Mr. Ellsworth waited near Snow Island until mid-January in the hope of suitable conditions. The weather had been very bad and the ice now began to threaten the ship. The *Wyatt Earp* sailed

north and a fortnight later was at Montevideo on her way back to the United States. Mr. Ellsworth's determination deserves a better reward.

The British Graham Land Expedition has successfully completed its outward voyage. An unpaid crew, well officered but otherwise with little or no sailing experience, has taken the *Penola* from St. Katharine Dock to the waters of the Antarctic. They reached Montevideo on November 11 after sixty-two days at sea. Surgeon Lieut.-Commander Bingham, who reached that port by cargo vessel with thirty-five Labrador sledge dogs a week or two earlier, had already taken them on to the more healthy Falkland Islands where Hampton and Stephenson were looking after the remains of their Greenland teams. Only fourteen out of more than sixty of these dogs had survived the disease which broke out among them during their long southward voyage. After a short stay at Montevideo, spent largely in adjusting the ship's wireless equipment, the *Penola* sailed on to Port Stanley, Falkland Islands. There she remained for a month while the cargo was restowed and alterations made to the rigging. While this work was in progress—on December 11—Hampton and Bingham sailed in the *Discovery II* taking with them the aeroplane and all the dogs. Ice conditions prevented them from reaching Port Lockroy directly, so Hampton and Bingham waited with their charges at Deception Island while the *Discovery II* did routine work in the South Shetlands. Then Captain Wilson picked them up again and, finding better ice conditions to the south, landed men, dogs, and aeroplane at Port Lockroy on January 11. The assistance she had given in sharing the *Penola's* load over the stormiest section of the voyage was very much appreciated by the expedition.

The *Penola* left Port Stanley on December 31, but it was soon discovered that the engine beds had shifted and that the transmission was therefore in danger. Rymill was unwilling to put back for repairs, for thereby he would probably miss the open season on the Graham Land coast. He decided to go south under sail and adjust the engines' alignment only when he reached his scene of operations. He sailed on at once, and after an excellent passage reached Port Lockroy on January 21. It was originally intended that the aeroplane should be rigged at Port Lockroy and reconnaissance flights made to discover the condition of the ice farther down the coast. We have not yet heard whether this plan was carried out, but if it was the work must have been done quickly and with satisfactory results, for on January 30 Dr. Charcot received a wireless message from the *Penola* which was then at Petermann Island 20 miles farther south. Winter quarters will probably be made anywhere within the next 200 miles of coast-line, the exact position depending on the formation of the land and the condition of the sea ice. The party now consists of sixteen men, for V. D. Carse was transferred from the *Discovery II* to the *Penola* at Port Stanley.

REVIEWS

EUROPE

IN AND UNDER BRITAIN: the Story of Coal. . . . By M. H. HADDOCK. *London: Crosby Lockwood & Son* 1934. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 252 pages; illustrations and maps.* 6*s* 6*d*

This book opens with a chapter on the nature and origin of the crust of the Earth, but it really deals with the formation of coal and the methods by which it is mined. Though the work of an expert it is written in non-technical language, it is well illustrated, and it ought to prove of interest to the general reader for whom it is intended. J. McF.

THE STORY OF CORNWALL. By A. K. HAMILTON JENKIN. *London: Thomas Nelson and Sons* 1934. $7\frac{1}{2} \times 5$ *inches; 150 pages; illustrations and map.* 2*s*

Cornwall, through all its history until a century or so ago almost cut off from England, is now finding many historians. Its story is safe in the hands of so competent an authority as Mr. Hamilton Jenkin, who writes simply for the general reader and misses practically nothing worth recording: he includes prehistory, together with the latest finds at Chysauster, Magor in Illogan, the only Roman villa known in Cornwall, the industries and sports and pastimes of the Duchy. Printed in a bold, clear type, and well illustrated, this book is excellent value for a florin, and such as a visitor would do well to take with him. Among the striking facts of Cornish industry is that stated by the author, that about 1850 "the mines of Cornwall were producing three-quarters of all the copper used in the world, and nearly half the tin." The miner however, though a skilled workman, remained very poor: he rarely made more than £3 a month on which to keep himself and his wife and family. A bibliography is provided, but no index to round off a very commendable book. S. E. W.

BEYOND THE GREAT GLEN: A Wayfaring Guide to the North-West Highlands. By F. REID CORSON. *London: Oliver and Boyd* 1934. $9 \times 5\frac{1}{2}$ *inches;* xvi+274 *pages; illustrations.* 10*s* 6*d*

THE WONDROUS ISLE OF STAFFA. By DONALD B. MACCULLOCH. *Glasgow: Alex. MacLaren & Sons* 1934. $7\frac{1}{2} \times 5$ *inches;* x+196 *pages; illustrations, map, and plans.* 5*s*

The first book is intended as a guide and companion for tourists who wish to know something of Scotland to the north and west of the great glen—Glenmore. The north-west Highlands are not greatly visited by holiday-makers, although the new road through Glencoe is bringing motorists through the Great Glen to Inverness, and some portions of this remote country are now likely to be better known. The book is extremely practical and is intended mainly for walkers and cyclists. A glance at any motoring map will make it clear that there is much in this part of Scotland that motorists will never see, and visitors who are not afraid to use their legs will do well to follow in Mr. Corson's footsteps. The notes on accommodation are specially useful in a country which is only sparsely populated, and it is interesting to learn that youth-hostels are to be found almost everywhere. The sketch-maps are numerous and clear, the tracks being shown by dotted lines.

The second book brings together a great deal of information—historical and scientific—which is not easily found elsewhere. Its author's family connection

with Staffa goes back to 1854. He has paid many visits to the island and his detailed surveys and measurements add much to our knowledge. There are chapters on the geological formation of the island, on flora and fauna, and on the relations of earlier travellers. Foreign visitors figure largely in the book, from Faujas de Saint Fond in 1784 to the King of Saxony who was there in 1844, after which foreigners become too numerous for separate treatment. The English and Scotch visitors also make an interesting company. The excursion is now far less venturesome than it was even fifty years ago, but tourists are not expected to sleep on the island, which has been uninhabited for more than a century. The author's experiences with his tarpaulins and waterproof sheets are not likely to encourage settlers, but his studies and his excellent photographs should add greatly to the pleasure of visitors. Some of the reproductions of early engravings are particularly interesting, and Mr. MacCulloch has discovered a foreign traveller hitherto unknown to most students, one Panckoucke, whose work was published in 1831. Panckoucke must have been a busy man, for during one day, apparently, he completed ten full-page drawings, a number of diagrams, and collected notes and descriptions for thirty-two pages of letterpress. Nor does he seem to have copied to any great extent from earlier travellers. One wonders whether, like Sir Joseph Banks, he also found time to cut his initials on one of the columns in Fingal's Cave. M. L.

DIE LANDWIRTSCHAFT VON ENGLAND UND WALES. By HEINRICH KELDORFER. Published by the Geographical Institutes of the Universities of Freiburg i. Br. and Heidelberg. *Freiburg im Breisgau* 1933. 9½×7 *inches;* xii+196 *pages. M.*5.50

This is a survey of English agriculture written for German readers. It is arranged in three chapters, of which I (pp. 9–90) is a description of the country in agricultural regions, II (pp. 91–131) discusses the natural bases of climate, soils, and natural vegetation; and III deals with the human factors. These chapters are preceded by a brief theoretical introduction, and followed by a list of the works consulted, a few statistics, and ten map-diagrams.

The author has not been able to visit all the regions he describes; but he has travelled widely in England, and he has evidently read very widely and carefully in the literature of the subject. His work is a thorough piece of compilation which should be of great value to those who are unable to read the English works on which it is based. C. B. F.

AN ALPINE JOURNEY. By F. S. SMYTHE. *London: Victor Gollancz* 1934. 9½×6 *inches;* 352 *pages; illustrations and sketch-map.* 16*s*

In the author's own words "this was a journey undertaken with the object of seeing as much as possible of Alpine Switzerland, its mountains, passes, alps, valleys, villages, towns and people, and of recapturing some of the charm of mountain travel so delightfully described by the pioneers of Alpine mountaineering and which breathes from the pages of 'Peaks, Passes and Glaciers'." The author goes on to say that "whether or not this spirit has been recaptured from the elaborately mapped, meticulously guide-booked and scientifically-run Switzerland of today, the reader must judge for himself." Mr. Smythe's object was to traverse Switzerland by high passes from east to west and to take in peaks on the way. He chose to go at Easter and to carry skis, which are usually indispensable at that time of year. It is as well to point out however for the benefit of other guideless climbers who may intend to follow in his footsteps that the time of year chosen for the journey may very likely be the most dangerous of any, and that unless his emulators are as skilful and experienced as the author

in the avoidance of avalanches they had better choose a more favourable season than Easter.

Starting from Bludenz in the Arlberg he crossed the Grisons and the Alps of Glarus, but was prevented by rapidly deteriorating weather from carrying out his plan of traversing the whole of the Oberland, and has therefore drawn on some of his past experiences in describing the latter district. Among these experiences is a day spent on the magnificent Guggi route up the Jungfrau. Mr. Smythe admits that he and his friend were unwise to begin their climbing season with such a formidable expedition, and that they owed their lives to the fact that the snowstorm with thunder and lightning which overtook them more than halfway up the mountain, providentially ceased soon after it had begun.

Finally, after visiting Bern and crossing the western Oberland, Mr. Smythe reached his homeward-bound train at Montreux. With the completion of his journey and the writing of this book the ambitious task that he had set himself came to an end. The two-fold enterprise has succeeded brilliantly. C. F. M.

ALPINE PILGRIMAGE. By JULIUS KUGY. Translated by H. E. G. TYNDALE. *London: John Murray* 1934. 9×5½ *inches;* xii+374 *pages; illustrations and sketch-map.* 12*s*

Nine years ago a great Alpine authority expressed deep regret that there was no prospect of an English translation of that sincere and eloquent book 'Aus dem Leben eines Bergsteigers,' and now here it is, and rendered into English by a translator who is worthy of his task. Dr. Kugy has been an ardent mountaineer all his life and is still in his old age the indefatigable lover of the hills among which he was brought up. More than half his book is devoted to the Julian Alps, of which he has such an extensive and intimate knowledge. These mountains occupy the extreme north-eastern corner of Italy, and their highest summit, the Triglav or Terglou, is the most important mountain in the extreme eastern region of the Alpine system. Before the war most of the Julian Alps were in Austria, but now the greater part of them belongs to Italy and Yugoslavia. The whole district has been little visited by British travellers, although there have been honourable exceptions such as Messrs. Gilbert and Churchill, to whose book Dr. Kugy pays high tribute as the authority which helped to introduce him to these mountains.

As a true lover of mountains the author objects to the term "sport" as applied to mountaineering, and it is clear that the element of competition plays only a small part in the making of his enthusiasm, for although it has fallen so often to his lot to be first, it is evidently more from accident than design. He has been a keen botanist, and, as he says, his mountaineering is founded on a love of nature; he never became a hunter although he travelled so often with sportsmen and poachers. "Chamois and ptarmigan," he explains, "have always been for me a mere symbol and embodiment of Alpine nature and mountaineering wizardry." Indeed it was men who were poets rather than mountaineers who first influenced the development of his taste. But the author has a far wider Alpine outlook than was obtainable from the constant journeys that he made among the mountains of his native land. He has a vast experience of all the Alps, especially of the greater snow and ice routes. Of mountaineers too as well as of mountains his knowledge must be unrivalled, for he has made innumerable friends among the foremost guides and amateurs all over the Alps.

The charm of this book is explained perhaps in the concluding lines of the author: "and now it seems to me that from the beginning to the ending, all has been a dream of celestial beauty." Certainly Dr. Kugy's writing nobly expresses the beauty of his thought, and grateful thanks are due to Mr. Tyndale for reproducing it unspoilt. C. F. M.

SPANISH RAGGLE-TAGGLE. By WALTER STARKIE. *London: John Murray* 1934. 9×5½ *inches;* xvi+482 *pages; illustrations and route-map.* 10s 6d

Professor Starkie has written as fine a book of Rabelaisian travel experiences as one could hope the twentieth century to produce. He plainly knows Spain, and particularly the gipsy life of Asturias where the scene of 'Spanish Raggle-Taggle' is laid, extremely well. Of his knowledge of the Spanish language the ordinary reader is indeed a little too aware: it should not be necessary for a travel book to have seven pages of glossary at the end, and why write *contrabandista* when the English language—in which after all nine-tenths even of this book are written—has the word smuggler? It is a book for the neo-mediaevalists; but for many twentieth-century readers this sort of humour and the romance of Catholicism are not very much alive.

The musical quotations are very interesting: as is all that Professor Starkie has to say about Spanish folk-music. M. DU P. C.

A WAYFARER IN POLAND. By MORAY MCLAREN. *London: Methuen & Co.* 1934. 7½×5 *inches;* x+206 *pages; illustrations and sketch-map.* 7s 6d

In contributing this volume on Poland to the Wayfarer Series, Mr. McLaren had no more ambitious an aim than to answer the question, How did you enjoy yourself, and what is the country like? And in this he has succeeded. Armed with a sheaf of introductions, he stayed at the best hotels, and ate in company at the best restaurants in the cities, while in order to see the country he followed the advice he tenders to the reader: "Contrive somehow to get asked to a big Polish country house." Here, on the very first morning, he was dragged early from his bed to go hunting the boar. "In a few minutes I had clambered into a shirt and wrapped the philabeg about me. I did not forget to put the *sgian dhu* into my stocking." A day punctuated by peasant wonderment at the kilt was closed by a hilarious dinner (where lesser folk "guzzled" below the salt) and the post-prandial enjoyment of lovely Russian dancing girls "escaped from the Soviet." This was hardly wayfaring; but passing from friend to friend's friend, the author contrived to see everything he should see, and discuss everything he should discuss—the Jews, minorities, the Corridor, Silesia. His prejudices are fairly obvious (new growth of hair on a young Jew's face "is a peculiarly repellent sight for Christian and Western eyes") but they are not intentionally obtruded. The key to his outlook is afforded by a chapter entitled "Polish Delight," which deals with night clubs and dancing. But in point of fact, Poland has other ways of being delightful. A flight of storks against a blue sky, the domes and pinnacles of Pinsk aspiring from the Great Swamp, the elfin trumpet notes that, with the pigeons, drop from the air in Cracow market-place, the bread and salt brought out by villagers in honour of the stranger geographers: all of these are memorable.

E. G. R. T.

THE SAAR AND THE FRANCO-GERMAN PROBLEM. By B. T. REYNOLDS. *London: Edward Arnold & Co.* 1934. 7½×5 *inches;* 280 *pages; illustrations and sketch-maps.* 7s 6d

This is, in the main, a straightforward account of events in Europe during the post-War period, in so far as they concern the relations between France and Germany in general and, more particularly, in connection with the Saar Territory. Major Reynolds was in the British Army on the Rhine and acted as liaison officer at French headquarters during the occupation of the Ruhr. Subsequently he was in business in the border zones of the two countries, gaining first-hand experience, for example, of the difficult period of deflation in Germany. These contacts have given him exceptional opportunity of observing and discussing

with those on the spot the repercussions in the Saar Territory of the changing European situation, particularly in regard to Germany.

Now that the plebiscite is over, perhaps the most interesting part of the book to the reader will be the chapter on the economic settlement. The problems that will arise are suggested rather than debated, but they provide useful food for thought. They will arise from the regain of control of industries by Germany, from the relatively high cost of production in Germany, from the competition of the Lorraine iron and steel industries, now almost entirely in French hands. Will the improvements effected in the Saar coal-mining industry under French administration enable it to meet Ruhr competition? Will trade relations with the Palatinate be re-established? What will be the effect on the Saar markets of the shifting of the customs boundary; of the liquidation of French interests in the Saar; of a possible further development of the coal-mining in that part of the basin which extends into Lorraine?

It is obvious that the author has striven honestly to give an unbiased account of events, although the reader will be left in little doubt as to where his sympathies lie. H. O.

FRANCE ON £10. By SYDNEY A. CLARK. (Ten Pound Series.) *London: Ivor Nicholson and Watson* 1934. 7×4 *inches;* 248 *pages; illustrations* (*by* DORIS SPIEGEL) *and sketch-map.* 5*s*

GERMANY ON £10. *Same author, publisher, size, and price.* 262 *pages; illustrations by* EDWARD C. CASWELL

ITALY ON £10. *Ditto.* 296 *pages; illustrations by* FREDERIC DORR STEELE

SWITZERLAND ON £10. *Ditto.* 212 *pages; illustrations by* EDWARD C. CASWELL

The alluring titles of these four little books do not mean quite as much as they seem to. The enthusiastic but impecunious traveller is assumed to have been deposited in Paris, or Cologne, or Naples, or somewhere unspecified in Switzerland, before he allows petty expenses to nibble the first morsel from his ten pounds. The exact length of his stay in each country does not seem to be indicated, and several chapters conclude with tempting paragraphs designed for those who are not strictly confined to the £10 limit. Furthermore the author betrays a natural tendency to emphasize any factor which tends to cheapness for the Englishman abroad, while averting his eyes from less convenient changes. Thus, while there is no doubt that travel in Germany has become substantially cheaper since the Hitler régime, experience shows that the opposite is true of France—certainly of Paris, where, in addition to the drop in the exchange value of the pound, food and other necessities actually cost more than before, as the French themselves complain.

Nevertheless these books will be found to contain a mass of valuable information on the different ways of economizing in four countries; they will probably prove more useful as a general help to the careful traveller than as an actual plan of operation to be carried out on ten pounds. Mr. Clark could teach the most experienced frequenter of third-class carriages and obscure but clean pensions something new in the art of doing things cheaply. We must not suppose that there is anything sordid about the author's economies. On the contrary: under his guidance we go everywhere and see everything (art, scenery, cathedrals, cabarets), and in Berlin, to our great astonishment, we find ourselves staying at the Adlon. Our guide even manages to "allow for at least one gay spree in each country."

It all makes a very pleasant prospect, and although we have not tested the

budget in the field the author's enthusiasm and confidence in its practicability are most persuasive as we read. Certainly the thing seems *possible;* but the less hardy traveller, required to cover so much ground in so short a time, might for that very reason demand more comfort in transport and hotel arrangements. Economy with enjoyment is easy to achieve so long as we stop in one place; but to cover hundreds of miles a week within the strictest financial limits might well become more of a task than a pleasure. Probably it is a question of temperament over which it would be useless to argue.

Mr. Clark writes in a light, easy style, occasionally descending to the facetious: he is not above heading a chapter "Swisscelany." He tells some good stories, the best of which is the dignified reply of a Neapolitan tout to an exasperated and threatening Englishman: "Sir, be quiet with your umbrella!" A finer lettering on the maps would have clarified the total effect and allowed for the insertion of more place-names. D. C. S.-T.

EUROPE: a Geographical Survey. By J. F. BOGARDUS. *New York and London: Harper and Brothers* 1934. $9\frac{1}{2} \times 6$ *inches;* xiv+714 *pages; illustrations and maps.* 16*s*

Here is another book which sets out to describe, from the American point of view, the geographical background of the major European problems. The survey ranges from a review of the world relationships of the continent, and the political, economic, and cultural activities of the European peoples, to the analysis of the physical regions of each political unit. It is stated to have been written as a text for University students, and to serve as a source of general information for the wider public, interested in European life and European problems, and it is clear that the different sections of the book will appeal to different readers. For the general reader, the introductory chapters on the importance of Europe to the world and to the United States and, later, the concise accounts of the general geography of the continent leave little to be desired, giving, so far as is possible in so restricted a space, a very clear picture of the geographic conditions. But the inevitable condensation and consequent generalization of the work as a whole have led sometimes to statements of doubtful accuracy. Is it true for example to say that there are "*three* types of towns in Europe which are of special interest from the geographic standpoint," or that the average Dutch farmer can see evidences of the "most perfect transportation system in the world" (p. 146)? As regards the regional sections, the book is characterized by a suitable selection of material and a very clear method of presentation. It is always difficult however to concur entirely with an author's "balance" in the different parts of a subject, and it is with a surprised interest that one sees ten pages allotted to the geography of Finland, while approximately three pages have to suffice for the consideration of the whole of Scotland. Further, both some of the subject-matter and its presentation seem to the reviewer to be too elementary for even the lower grades of University work, and the book appears better suited for the school library. It is fully illustrated with maps and diagrams, not all well produced, many being difficult to see and interpret (*e.g.* those on pp. 108, 183, 601). There is a list of references at the end of each chapter, usually well selected, though some unexpected omissions occur, as that of all the works of De Martonne from the references cited for France.

Against all such criticism however and far outweighing it, there is the general interest of the book, which gives the impression that the author has enjoyed writing it—a sure way of securing that the reader will enjoy it too. B. H.

ASIA

GEOLOGICAL ATLAS OF EASTERN ASIA. 1 : 2,000,000. *Edited by the Tokyo Geographical Society* 1929. *17 sheets; 21 × 20 inches.*

This finely executed atlas of seventeen sheets embraces an area between 100° and 158° E., and between 22° and 52° N., that is to say it includes practically the whole of the three great river basins of China, with the Amur and Selenga basins, on the mainland, together with the island loops from Kamchatka to Taiwan. Place-names are in Japanese, but a few key-names in English are added for the convenience of the Western reader. The brief text, dealing with the sources of material and methods employed in making the map, is in English and Japanese. The work of compilation was entrusted to a committee under the general editorship of N. Fukuchi, and the Atlas is published under the auspices of the Tokyo Geographical Society, a sufficient guarantee of a high standard of workmanship alike on the geological and cartographical sides. Each sheet is drawn on a polyconic projection, although squared off to fit the page. Necessarily the separate sheets cannot be fitted together into a single map, which is to be regretted, for the result would have been a magnificent conspectus of the structural features of a very complicated area. The sedimentary and metamorphic rocks are differentiated in the first instance according to epoch, and further according to facies; the eruptive and intrusive igneous rocks are differentiated according to composition only as basalts, granites, diorites, and so on, without reference to age. The resultant division, so far as Eastern Asia is concerned, is into seventy-six categories, all of which are set out alongside every sheet, colour being added only when the particular formation appears on the particular sheet of the map. Loess is classified under two headings, pleistocene loess being distinguished from "aeolian sand loess" of recent origin. Geographers will find the Atlas particularly valuable for studying the intricate boundaries of the red earth, loess, and alluvial soils, which have played so important a part in the human geography of Eastern Asia, while students who have interested themselves in recent hypotheses regarding the origin of the major structures of Asia can here test them against the findings of the geologists. E. G. R. T.

THE MONGOLS OF MANCHURIA. By OWEN LATTIMORE. *London: George Allen & Unwin* 1935. *8 × 5 inches; 312 pages; maps.* 8*s* 6*d*

TENTS IN MONGOLIA (Yabonah): Adventures and Experiences among the Nomads of Central Asia. By HENNING HASLUND. *London: Kegan Paul, Trench, Trubner & Co.* 1934. *9 × 5½ inches;* xvi + 366 *pages; illustrations and sketch-maps.* 15*s*

Owen Lattimore is best known to the general reader as the author of 'The Desert Road to Turkestan' and of 'High Tartary.' In 'The Mongols of Manchuria' he carries one stage farther the valuable contribution to our understanding of the people begun in 'Manchuria: Cradle of Conflict.' The book is packed with detailed information, secured on the spot or from sources not generally available, bearing on the historical background relationships and distribution of the various tribes. This constitutes the outstanding value of the book to serious students of Mongol affairs. It makes no pretence at describing Mongol life and only touches on sociological matters incidentally.

The author has in addition a three-fold thesis for which he pleads: the historical importance of Mongolia and the Manchurian "reservoir" as a dominant factor in Chinese history; the racial and social superiority of the Mongol over the Chinese; and the significance of the Mongol in Manchukuo as a potential determinant in the future of Asiatic politics. The three propositions are clearly

of unequal validity and will meet with varying acceptance. In fact, it is in the effort to combine the functions of an authoritative source-book with those of the special-pleader on a topic of popular appeal that the defect of the volume lies.

The general reader may have been led to expect a book in popular style, offering a new-found clue to oriental politics. Instead he finds a volume, much of which to be intelligible calls for close concentration, bristling with Mongol names and requiring constant reference to a map which is inconveniently placed so that it faces the wrong way. The serious student of the subject, to whom the real value of the book will be at once evident, may, on the other hand, be put off by the obvious bias in favour of the Mongol as against the Chinese. Nevertheless the emphasizing of a neglected truth as if it were the whole truth is often the best way to ensure an accurate perspective instead of a flat picture, provided a second impression from a different point of view is also obtainable. A partisan statement is both more interesting to write and more stimulating to read than the dull monotony of judicial balance.

The book virtually falls into two parts, which might have been more clearly demarcated. One almost wishes that the author had concentrated the wealth of information regarding the origins and organization of the various leagues, tribes, and banners into one volume and devoted another to the present-day political aspects of more general appeal. Evidently practical considerations were against this, so that the two aspects are intermingled. The research behind the written page is of a scholarly character and the author shows skill in assessing the data dealing with the changes since the beginning of the century. The maps form a contribution in themselves, making available for the first time the painstaking work of the Japanese cartographers on the location of the Mongol Banner frontiers. As the preface rightly says, "The Mongols are a people whose problems are too little understood or cared for by the world at large." The author has done them signal service by drawing attention to important elements that have been generally overlooked because hitherto unknown.

Henning Haslund was a member of Carl Krebs' expedition to Bugun Tal in Uriani, the erstwhile "no-man's-land" south-west of Lake Baikal between the spurs of the Tannuola and Saian ranges over which neither Mongolia nor Russia claimed control. The original intention was to start a Danish pastoral and agricultural settlement, which would serve also as a base from which to develop a trade in furs and, if conditions were propitious, to exploit the mineral resources of the district. On account of political troubles, the tangible results achieved were less than was hoped for, but in 'Tents in Mongolia' the story of the exciting experiences of twenty months is told in a breezy style that makes it one of the best adventure tales one could wish. The author's ability to describe events vividly and to recapture and convey to the reader the passing emotions of the moment is uncanny and in places invests the picture with a tinge of unreality. How far the high colouring of some of the incidents and the almost naïve narration of some of his exploits are due to the translator's being personally unfamiliar with the country the reviewer cannot decide.

The same scene may take on diverse colours to different observers. On consulting his field-notes the reviewer finds that he was working in the pass above Kalgan the day the Krebs party went up into Mongolia, and he yet missed some of the glamour which the day had for Haslund, even though the latter was recovering from dysentery. One needs the fresh eye of the newcomer to secure the vivid impression. And for a vivid picture of Mongol life, seen through the eyes of an alert, virile, friendly, and impressionable observer, the book would be hard to beat. It is full of illuminating sidelights on the workings

of the Mongol mind, and the account of the séance at which the Shaman drives out the evil spirit has real dramatic quality. In contrast to Lattimore, Haslund criticizes adversely the Young Mongol party, feeling that they have sold their country to the Soviets. The treatment he received at the hands of his Soviet jailors was hardly calculated to improve his opinion of the system. The book is well illustrated and frankly popular in its appeal. It would be hard to find anything more in contrast to Lattimore's book than 'Tents in Mongolia.' For that very reason, using the two as companion volumes, the thoughtful reader may get a surprisingly good picture of the Mongol people. G. B. B.

THE WHEELS OF IND. By JOHN W. MITCHELL. *London: Thornton Butterworth* 1934. 9×5½ *inches;* 320 *pages; illustrations and map.* 12*s* 6*d*

This book is not, as may at first sight appear, one of those volumes, so frequent nowadays, of the fugitive impressions of a holiday traveller or high-velocity news-getter. It is a simple and rather fascinating record, by a young man with a turn for writing, a love of his job, and a humorous appreciation of his surroundings, of service with the Bengal–Nagpur Railway Company. A record of hard work, of sport, and of close association with many varieties of Indian humanity. After an opening chapter devoted to the usual incidents and impressions that attend the young adventurer on his first experiences of India, the writer settles down to life as an Assistant Traffic Superintendent at Bilaspur on the Calcutta–Bombay main line, describing the duties and pleasures of existence in an Indian Railway Settlement with an indomitable enthusiasm, and incidentally imparting much interesting information regarding the Indian railways generally, which, he considers, constitute "the greatest gift of Western Materialism to Mystical India." Importing a few statistics into his narrative, he proves the magnitude of that gift: its 7000 miles of line, its spacious rolling stock, its mammoth locomotives, its speed, punctuality, and comfort, and its annual passenger list exceeding five hundred millions. And his frequent anecdotes concerning the idiosyncrasies of his Indian colleagues will evoke speculation as to what may happen to the "gift" when the advancing Indianization of its personnel shall have been completed. Amongst his relaxations sport holds first place, and two diverting chapters are devoted to encounters with big game, interspersed with tales of the jungle folk who helped to find it and with whom much of his leisure was passed. The book is dedicated to the author's own particular "old Shikari."

In course of time a transfer to the Bokaro coalfield directed the officer's attention to another aspect of the gift, namely, its contribution towards the nascent industrialism of India, as provider of fuel and distributor of products to and from the ironworks, steel works, cement works, cotton mills, and other industries now busy converting the poverty-stricken but more or less happy Indian peasant into a better paid but discontented town-dweller. In a chapter both instructive and amusing the writer tells of his work and adventures in the coalfield and discusses the characteristics of the very mixed population that lives, works, and quarrels in that arid and grimy corner of the Empire.

The third and last part of the book relates to the southern arm of the Bengal–Nagpur Railway that extends down the south-eastern part of Orissa, where the author, having been transferred to this section of the line, finds himself in quite new surroundings. A green and smiling land of tree-embowered villages and open ricefields, watered by many rivers and bounded by blue mountains in the distant west and by the Indian Ocean to the eastward. A land hitherto untouched by industrialism, where a bucolic race lives as its ancestors lived a hundred generations ago. A land, above all, of temples with, first amongst them, the far-famed shrine of Jagannath at Puri; lodestar of pilgrims from all over India. The

author gives a most interesting and entertaining account of Puri and its temples as they are to-day and of the transport organization for dealing with the vast concourse of pilgrims who attend the annual Jagannath festival. And a comparison of his happy experiences with the grim narrative of Hunter written in 1872, will show the value of the Indian railways from yet another view-point. In this last chapter, perhaps the best part of the book, the pertinence of "wheels" in the title explains itself, suggesting as it does the combination of material and mystical symbolism. Mr. Mitchell knows the uses of the written word and holds the unflagging attention of his reader as he passes from scene to scene and from mood to mood. The style is pleasant and easy, the illustrations are good, and there are four maps and an index. W. A. G.

THE FIRST CENTURY OF BRITISH JUSTICE IN INDIA: an Account of the Court of Judicature at Bombay, established in 1672, and of other Courts of Justice in Madras, Calcutta and Bombay, from 1661 to the latter part of the Eighteenth Century. By Sir CHARLES FAWCETT. *Oxford: The Clarendon Press* 1934. 9×6 *inches;* xx+270 *pages; sketch-maps.* 15*s*

As will be realized from the references cited on pp. 229–254 of this volume, Sir C. Fawcett has performed a laborious task in compiling an account of what he calls the first stage (1661–1765) of the history of our courts of law in India. When the East India Company's commercial settlements grew in number and importance and became grouped under "Presidencies," the chief judicial, as well as executive, functions were vested in the Governor and Council. As territorial and administrative responsibilities expanded, the cases for decision increased in number and complexity, and the want of special courts and trained lawyers became felt. That Bombay was the first place where British justice was administered to the people by a special Court of Judicature was due to the terms of the Charter granted in 1668 to the Company by Charles II when he made over the Port and Island of Bombay which had been ceded to him by Alphonso VI under the marriage treaty of 1661. This Charter contemplated the establishment of courts on English lines and the framing by the Company of laws "consonant to reason, and not repugnant or contrary to, but as near as may be agreeable to the laws of" England. Sir Charles has discovered and reproduced (pp. 18–28) a copy of the Company's "laws" then made. These contained provision for the establishment of a "Court of Judicature" for the trial of all suits and criminal matters, under a judge to be appointed by the Governor and Council, by a jury of twelve Englishmen, except when any party to the dispute was not English, in which case the jury was to be half English and half non-English. This court was inaugurated in 1672 by Bombay's first great Governor, Gerald Aungier. Its working under successive presiding judges has been described at some length, and incidentally several errors and misconceptions of previous writers have been corrected. Shorter accounts are given of other courts of justice in Madras, Calcutta and Bombay. Attention has been duly drawn to the important change made in 1726, when a fresh Royal Charter provided for the establishment of civil and criminal courts deriving their authority from the King instead of from the Company. This conflicted with the policy hitherto persistently pursued by the Company of keeping the judicial appointments under their own control. We see growing up a spirit of independence and a tendency to conflict between the executive and judicial branches, destined to culminate at a later stage.

The author, a judicial officer of distinction himself, comes to the conclusion that the early courts, in spite of defects, "made an effective contribution to the development in India of the high standard of justice that is one of the pillars of

the British Empire." We may add that this volume also bears ample evidence of the solicitude of the Company's Directors in London for the just and impartial administration of the laws. C. E. A. W. O.

A PLANT HUNTER IN TIBET. By F. KINGDON WARD. *London: Jonathan Cape* 1934. 8×5½ *inches; 318 pages; illustrations and maps.* 12*s* 6*d*

All those interested in travel in Tibet, and more especially in the plants in the south-eastern part of that country, which Captain Kingdon Ward has made peculiarly his own, will have been looking forward to the appearance of his latest book, the more so as our appetites have been already sharpened by Mr. Ronald Kaulback's account of portions of the same journey. The reader will not be disappointed. The relation of the details of the journey and more especially of the botany holds the attention throughout the volume. The illustrations have even exceeded the usual high level which we now expect from this author; but the two small maps between pages 84 and 85 leave much to be desired.

The country visited is the portion of south-eastern Tibet north of the Mishmi hills, the general outline of which was already known; but the author's success in reaching the Salween, at a point, if we mistake not, very far distant from where any other traveller has located it, is a matter of great geographical interest, and during this part of his journey he was able to fill in an extensive gap in our maps. His statement that there are no maps of Tibet on a scale larger than 16 miles to an inch requires some qualification. The work done by the Younghusband Expedition and its subsequent explorations was on a scale of not less than 4 miles to an inch, and the considerable areas mapped by the late Captain Morshead in 1913 as well as the work of the late Captain Meade were also on this scale. These surveys comprise a large part of the less thinly populated portions of the country. In the interests of future travellers it is important too to query the statement that the Zo La can be crossed at any season. At the end of June the pass was under deep snow and must have been impassable a month or so earlier. The reference to black "horsehair" tents is probably a mistake for "yak hair" of which latter material Tibetan graziers usually make their tents. The prohibition of cigarette smoking in Rima is not the whim of a zealous reforming governor, but a stringent order from Lhasa forbidding smoking throughout the country.

Captain Kingdon Ward did a fine piece of work in reaching the summit of the Jara La, whence he looked down on to the headwaters of the Tangon branch of the Dibong. This valley is not unexplored. It had been thoroughly surveyed in 1613 when Captains Nevill and Nicolay reached to within a few miles of the pass, for which they obtained the name Kaya La from the Mishmis, and of which our surveyors made the altitude to be 15,700 feet. The Bebejiya Mishmis, whom the author met at Sole, had probably (unless they were too young) seen Europeans in 1913 when the valley was surveyed and all but the most inaccessible villages visited.

The perseverance required in the task which Captain Kingdon Ward sets himself must be the admiration of all. Time after time the photography of beautiful flowers is prevented by rain, snow, and wind, and the photographers had to wait for hours in inadequate shelter in the hope that a break in the storm would allow them to get a shot. We can well imagine their feelings on these occasions, with perhaps the additional worry of dealing with coolies or the murder of a mail runner, and other difficulties inherent in a journey of this kind. Of many plants only seed was obtained and it will be interesting to see what comes of these. The author's great knowledge and experience enable him to recognize useful and new plants when in seed, and he is probably more successful than any one else in bringing them home in such a condition that they will germinate. F. M. B.

AFRICA

THE LION'S ROAR. By CHERRY KEARTON. *London: Longmans, Green & Co.* $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* 188 *pages; illustrations.* 6*s*

Mr. Cherry Kearton tells a tale of African magic. It is not intended for the serious student, but for those who like a stirring story interwoven with pictures of African wild life. There are exciting descriptions of battles between elephants, raging bush-fires, and devastations caused by streams of lava, while the general life of the African village is vividly portrayed. R. W. G. H.

MUNGO PARK AND THE QUEST OF THE NIGER. By STEPHEN GWYNN. (The Golden Hind Series. Edited by MILTON WALDMAN.) *London: John Lane* 1934. $9 \times 5\frac{1}{2}$ *inches;* 270 *pages; illustrations and maps.* 12*s* 6*d*

Fellows of the Society do not belong to that category of "general reader" which confuses the name of Mungo Park with that of Marco Polo, as is often the case according to Mr. Gwynn, but they will none the less appreciate the graceful style in which this last addition to the Golden Hind Series is written. Mr. Gwynn has nothing new to add to a well-known story, but he wisely quotes freely from Park's own narrative, pauses to consider contemporary views on the Niger problem, and, in the last three chapters, sketches the subsequent history of the exploration of the river. If the general reader requires references to the literature of the subject he will find little help in this volume. The two maps are also disappointing: a reproduction of one of the maps from Park's Travels is so small as to be illegible, while on the modern map many places named in the text are not marked and there are numerous inconsistencies of spelling. Despite these drawbacks the book is of value. The author justly appreciates both the character and the accomplishments of Mungo Park, whose life is summed up in the phrase "a long career of self-devoting heroism," and whose journeys "opened the way for Europe into the Africa which lies behind the fever-breeding forest belt of the West Coast." A reasonably complete account of a very important period of nineteenth-century exploration in Africa is given from which the reader will be able both to appreciate Park's contribution to the solution of a great geographical problem and to realize how much of that problem he left unsolved. J. N. L. B.

SPORT AND TRAVEL IN EAST AFRICA: an account of two visits, 1928 and 1930. Compiled from the private diaries of H.R.H. The Prince of Wales, by PATRICK R. CHALMERS. *London: Philip Allan* 1934. $9 \times 5\frac{1}{2}$ *inches;* xii+274 *pages; illustrations and maps.* 12*s* 6*d*

The Prince of Wales visited East Africa in 1928 and 1930. Much of his time there was spent on safari, shooting and photographing wild game, and here we have a personal record of these experiences. With the help of the Prince's diaries and photographs, supplemented by private interviews with him, Mr. Patrick Chalmers has composed a lively account of his adventures, and one which illustrates very clearly the Prince's love of sport.

His first visit in 1928 was to Kenya, Uganda, and Tanganyika. We are given an account of the voyage out, told how he amused himself on board ship and what he did at the various ports. Then we travel up to Nairobi; here we are in a whirl of official functions, addresses, parades, inspections, balls, dinners. In Uganda another round of official duties is performed, and it is a relief to get off to the wilds. Near the Murchison Falls the Prince shot his first elephant. At Kigoya a screaming elephant came on top of the Prince and his two rangers, one of whom

shoved the Prince flat into a thorny bush and then brought the charging elephant to its knees at a distance of 8 feet. At Dodoma a telegram arrived telling of the King's illness, and four days later more serious news brought the African safari to an end and sent the Prince post haste to England.

The second expedition in 1930 began with an official visit to South Africa, followed by a safari in Kenya, Uganda, the Belgian Congo, then northward through the Sudan to Egypt. In addition to the personal matter of the narrative, there are many notes on the scenery and characters of the country, accurate descriptions of the habits of the wild animals, and historical notes on places of interest especially with respect to incidents in the Great War. The record should interest many people. It is written in a pleasant, humorous vein, and reveals the Prince as a true sportsman undismayed by danger and indifferent to discomfort.

R. W. G. H.

POLAR REGIONS

NORTH TO THE RIME-RINGED SUN: being the Record of an Alaskan-Canadian Journey made in 1933–34. By ISOBEL WYLIE HUTCHISON. *London: Blackie & Son* 1934. 8½×5½ *inches;* viii+262 *pages; illustrations and map.* 12*s* 6*d*

This book is a detailed account of a single-handed journey which Miss Hutchison undertook in 1933–34 to make a collection of Alaskan plants for Kew herbarium, and of Eskimo relics for the Cambridge Ethnological Museum. Her lively, often ecstatic, prose, varied with much verse of her own composition, is most successful in the later part of the book when she returns to the Far North which exerts even more than its usual fascination over the author's sensitive nature. It is not till she reaches Skagaway that the narrative becomes more than a typical, though vigorous, tale of travel, complete with irrelevant details, humorous anecdotes, and casual conversations.

From Skagaway, by rail, river-steamer, and aeroplane, she reached Nome, where she persuaded the skipper of a 10-ton trading-vessel to take her right round the north of Alaska to Herschel Island in the mouth of the Mackenzie Delta. But it was a bad ice year, and after many vicissitudes the little boat got ice-fast off Point Barrow (lat. 71° N.); it was now September, and the Estonian trader who took charge of her was also unable to reach Herschel Island before the freeze-up. The next few chapters—where one longs for much more detail—are the best part of the book: Miss Hutchison stayed with the trader (who was one of Storkerson's ice-drift party in Stefansson's Canadian Arctic Expedition) till the ice became firm, and then, with four dogs pulling sometimes as much as 1000 lb., they set off to sledge 120 miles to Aklavik. In this and the next stage of her trip she slept in a snow-house, encountered temperatures of −38° F., and had all the adventures one would expect on such a journey. At Aklavik the temperature fell to −58° F., and she waited there till the February Air Mail took her up the Mackenzie River and so back to the "Outside."

It is no wonder that the Scottish Geographical Society awarded Miss Hutchison the Mungo Park Medal on the strength of her remarkable journey.

F. S. C.

ESKIMO YEAR: A Naturalist's Adventures in the Far North. By GEORGE MIKSCH SUTTON. *New York (and London): The Macmillan Company* 1934. 9×5½ *inches;* xii+322 *pages; illustrations.* 12*s* 6*d*

Mr. Sutton, of Pittsburgh, had the good fortune to spend the year 1929–30 studying biological problems on the barren tundra-like Southampton Island—or

"old Shugliak," as he affectionately calls it—in the mouth of Hudson Bay. His scientific reports are published elsewhere; 'Eskimo Year' is, to quote the Foreword, "a study in human adjustment, to some extent. A study in relationships. But first of all it is the story of a glorious adventure in a glorious country." The unusual style of this book is at first annoying—the staccato Americanisms, the coined words, and the intimate conversational manner with innumerable rhetorical questions and asides; but gradually we realize that this desultory confidential style exactly suits the author's disconnected material. Here is a humorous, almost a facetious dissertation upon huskies put in between a chapter on frostbite, fox-trapping and the winter dress of Arctic fauna, and a dramatic account of two Eskimos drifting out to sea on an ice-floe.

The author, like most young men who winter in the North, tries to "go Eskimo": he envies their philosophy, their social system, and their open happy-go-lucky temperament. Seeing both Anglican and Roman Catholic missions for this handful of Eskimos he marvels at "this strange urge to educate and improve and change a people that have evolved for themselves a dignified culture, an adequate religion, and, above all, a serene contentment." His chapters describing hunting trips with the natives are perhaps the best in the book. The Shugliamiut—of whom Therkel Mathiassen has written—died out in 1902; and the present population, a mere 150 Eskimos, were brought from Repulse Bay and Baffin Island. As far as hunting resources are concerned the island seems to be well favoured: herds of caribou roam the desolate plains; eleven polar bears are seen at the same time; walrus, white whales, and even the scarce bowhead abound; bearded, Greenland, harbour, and fjord seals are seen in considerable numbers; in addition to these we read of char by the sackful, innumerable ptarmigan, hares, foxes, wolves, and lemming. It is therefore rather disappointing to hear of Eskimos wearing creaking tan shoes, pale blue suspenders, and even high heels. The cold of winter however forces them to resort, for a time at any rate, to the caribou-skin clothes, snow-houses, and blubber stoves of their ancestors.

'Eskimo Year' is illustrated by a number of photographs and a series of most attractive black-and-white drawings by the author. It is a pity there is no map.

F. S. C.

WATKINS' LAST EXPEDITION. By F. SPENCER CHAPMAN. *London: Chatto and Windus* 1934. 9½×6 *inches;* xvi+290 *pages; illustrations and maps.* 15*s*

It will be remembered that when Watkins returned from the British Arctic Air Route Expedition he at once began trying to raise money to enable him to sledge across the Antarctic Continent, probably the most difficult polar journey still remaining to be made. Watkins' greatness as a leader and his personal determination and courage would certainly have given him every chance of success, but the request for money coincided with the worst stage of the financial depression, and the plans had to be abandoned. Instead, Watkins with three companions, John Rymill, Quintin Riley, and F. Spencer Chapman, returned to East Greenland on what seemed an expedition of minor importance but was clearly regarded by Watkins as a further preparation for an ultimate trans-Antarctic journey. On his previous expeditions to Labrador and East Greenland, Watkins had realized that the methods of travel adopted by the local people were the surest basis for his own journeys. His last expedition had two objectives: one was to further in various ways the project of an Arctic air route, and the other, of equal importance, was to learn still more of the Eskimo methods of life and travel.

In the first chapter of his book Mr. Chapman tells of the struggle before the plans for a trans-Antarctic journey were abandoned, and then of the hasty preparations for a return to Greenland. Watkins died before the work of the expedition had really begun, but those who wish to glean a little more about the remarkable personality of the leader of the expedition will naturally turn to the early part of this book. The account of Watkins' death is mainly given in the form of quotations from Chapman's diary, which is no doubt as satisfactory a method as could be devised; but the reader must constantly bear in mind that the diary is a personal account recording uncritically the intense feelings of the author at the time.

Interest in the book may flag a little during the description of the autumn journeys, and sometimes also the reader is conscious that parts of the diary quoted were written with the idea of publication. But later Chapman succeeds in conveying his joy and enthusiasm for travelling, as he says, "in a country which is still in its glacial period and with a people just emerging from the Stone Age." The descriptions of the Eskimos and especially of their hunting methods are not written by an external scientific observer but by one who has lived among them as one of themselves. He has often gone out at dawn without eating, accompanied by two or three Eskimo, hunted the cautious seal all day, and then returned in the evening to a meal prepared by the Eskimo women of boiled seal meat and blubber. The last chapter of the book gives a description of a journey made with a family of Eskimos for 100 miles down the coast from their winter to their summer hunting grounds. It is the sort of exciting and dangerous journey which is a commonplace to these courageous people but which has, I suppose, never been made before by an Englishman.

The book is necessarily mainly personal, and in fact it is to some extent an unconscious study of the character of the author. The scientific work of the expedition, the painstaking recording of facts about the weather by Riley, and the detailed survey, largely the work of Rymill, are adequately though briefly dealt with. Such work does not make good material for a popular book on the Arctic. Actually the survey journeys had to be considerably curtailed after the loss of the leader of the expedition, for the survey party then consisted of two instead of three. It is unsafe for two to cross Greenland glaciers, because it requires more than one man to extricate a companion who has fallen into a crevasse. It is clear that Rymill pushed to the limits of safety his journeys through this difficult country.

The production of the book is on the whole satisfactory. Mr. Augustine Courtauld provides exactly the right introduction, since he knows both the land and the author. The photographs are numerous and not only give information which is required to understand the book properly, but are in many cases pleasing pictures. The index is valueless and is presumably the work of a professional indexer. There is no reference therein either to sledges, dogs, or kayaks. The reviewer discovered this when he attempted to turn up a point about their sledging dogs. The nearest word was "*Doyle, Conan*": every book casually mentioned by Chapman as having been read by himself or his companions is referred to in the index.

As a racy and well-written account of a year in the Arctic with the Eskimos the book should meet with wide approval. Besides this, it is valuable because it gives fresh information about Watkins. The descriptions of Eskimo methods of hunting, especially from the kayak, are also sufficiently detailed to be of great value to any one who wishes to practise this art in Greenland or elsewhere.

L. R. W.

PHYSICAL AND BIOLOGICAL GEOGRAPHY

THROUGH SPACE AND TIME. By Sir JAMES JEANS. Based on the Royal Institution Lectures. Christmas 1933. *Cambridge: University Press* 1934. $8\frac{1}{2} \times 6$ *inches;* xiv + 224 *pages; illustrations.* 8*s* 6*d*

This book by Sir James Jeans contains the substance of the lectures which he delivered at the Royal Institution during the Christmas season of 1933–4, "in a style adapted to a juvenile auditory." The author discusses in turn the Earth, the air, the sky, the moon, the planets, the sun, the stars, and the nebulae, thus covering the whole realm of space; and in his discussion of the evolution of the stars and of the solar system, and in his outline of the geological and biological evolution on the Earth, he takes his reader through an immensity of time. Throughout the book the most abstruse problems of astronomy are discussed with a clear simplicity of style which never fails to emphasize the crucial points of the discourse. The reproductions of photographs of a wide variety of objects, from the *Diplodocus* to the whirlpool nebulae, are all very beautiful and well done, and the book is admirably printed in Bembo.

The author is perhaps less happy in his treatment of the atmosphere of the Earth than in the remainder of the book. Thus on p. 59 he gives a questionable view of the relationship of wind and rain, and the discussion of the eleven-year sunspot period in certain atmospheric phenomena gives to meteorology an air of simplicity which, alas, it does not possess. Jeans quotes the Trade winds as evidence of the Earth's rotation, but perhaps the most convincing atmospheric evidence of the Earth's rotation is to be found in the cyclic rotations in cyclones and anticyclones, which both rotate in space in the same sense as the Earth. The only possible source of the supply of the large amounts of angular momentum involved in these circulations is to be found in the rotation of the atmosphere with the Earth.

A pleasing feature of the book is the inclusion, here and there, of some of the main historical facts of astronomical history, in such a way as to add to the interest of the narrative without imposing a tax on the reader's memory. Altogether, this is a book which cannot fail to interest a wide circle of readers. D. B.

THE CONTINENTAL UNDULATIONS OF THE GEOID. By R. A. HIRVONEN. Publications of the Finnish Geodetic Institute, No. 19. *Helsinki* 1934. $9\frac{1}{2} \times 6\frac{1}{2}$ *inches;* 89 *pages; map*

Professor Heiskanen asked the author to undertake this work with the object of answering three questions:

(1) Is the existing gravity material sufficient to give any information respecting the undulations of the geoid?
(2) Of what order are the warpings of the geoid?
(3) Has the ellipticity of the Equator computed from gravity anomalies by aid of Clairaut's formula any test in the undulations of the geoid?

Such an investigation is very welcome. It is now eighty-five years since Stokes gave a formula in which the departure of the geoid (or Earth's sea-level surface) from a spheroid of reference, with centre at the centre of gravity of the Earth's mass and minor axis coincident with the Earth's axis of diurnal rotation, was expressed as an integral of the anomalies of gravity; the anomalies being reckoned from the values of gravity corresponding to this reference spheroid, regarded as a level surface of a gravitational, rotating body comprised within the spheroid. Though criticisms have been made in the intervening time as to the validity of Stokes' result, his formula survives and very rightly is the basis of the publication under review.

When Stokes wrote his paper gravity survey was so incomplete that no immediate use could be made of his formula. It contained however the indications of what gravity measurements were needed for the satisfactory delineation of the Earth's figure, and, had greater attention been paid to it, the distribution of observational effort might have been made more effectively. Since Stokes' integral demanded values of g well distributed over the whole surface of the Earth—ocean as well as land—probably little hope was entertained of its practical evaluation. But when observation of gravity at sea became an accomplished fact the situation was entirely modified, and the use of the formula became not only feasible but very desirable. It is surely of as great interest to know the true shape of the Earth as to know many of the interesting and wonderful facts elucidated by modern astronomers. It is moreover becoming of increasing importance to surveyors to know more of the particular shape of the Earth on which they make their measurements. The subject of this review is a step in that direction.

The author displays a courage which is well in keeping with the progressive spirit of the Finnish Geodetic Institute. He begins with a brief résumé of the work of Stokes, Helmert, Pizetti, and others in this field—the value of which is increased by the fact that their writings are not easily accessible and, in many cases, probably unknown to practical geodesists. He then formulates a scheme of attack, and one is almost carried away by the enthusiasm with which he sets out to the "hypothetic completing of the gravity field." Gravity has been observed at several thousands of places on the Earth, by land and by sea. Had they been distributed to the best advantage for the present purpose the results would have served well. Actually they are (relatively speaking) mostly crowded up into Europe, North America, and half of Asia; in fact the bulk of the gravity stations are contained in about 3 per cent. of the Earth's surface. The situation in the southern hemisphere is indeed desperate. Here the author is able to assign values of anomalies of gravity to 41 out of a total 1003 areas of subdivision; and of these at least 28 appear to be from coastal stations which are apt to be far from representative. Referring to Africa, he says: "Generally Africa pertains to the unobserved regions, wherefore there is no benefit in applying Stokes' formula there." None the less he actually infers, and duly employs, anomalies for each of his areas of subdivision of the globe. As seems still to be popular, he calls in to his aid isostatic compensation "which is to be considered as a proved fact" (p. 49). A little later (p. 50) he says: "The exceptional negative squares on the Alps (anomalies $\angle$ 10) can be explained by the isostatic overcompensation"; but he passes without further comment the largest anomaly, "−163 at the root of the Himalaya." The anomalies in regions devoid of data are accordingly based on the isostatic hypothesis, and are hardly likely to yield the peculiarities of the figure of the Earth, *e.g.* the alleged ellipticity of the Equator which, if established, is a contradiction of isostasy. Having formed his gravity field for the whole Earth, he derives the corresponding geoidal elevations at some sixty points, all of which are situated in regions where observational results are fairly plentiful. He applies these results to a determination of the equatorial ellipticity. The concluding portion of the paper is concerned with estimation of accuracy and is valuable; and at the end there is a useful summary.

The paper displays the imperative need for an early world gravity campaign under international auspices. It shows how, with adequate data, the broad features of the geoid may be computed on lines briefly set forth. In the opinion of the reviewer the actual numerical results obtained cannot be considered to give a useful picture, and the author claims (in his summary) no more than

that they "are right as regards their sign and order." The reviewer cannot agree that "the ellipticity of the Equator can be considered as sufficiently proved," nor that the estimate of −50 m. for the average warping of the geoid is surely established. J. DE G. H.

ECONOMIC AND HISTORICAL GEOGRAPHY

A GEOGRAPHY OF COMMODITIES. By H. ALNWICK. (Harrap's New Geographical Series. General Editor: R. N. Rudmose Brown.) *London: George G. Harrap & Co.* 1934. 10×7½ *inches;* 146 *pages; diagrams and sketch-maps.* 3*s* 6*d*

In 'A Geography of Commodities' Mr. Alnwick has made a serious and on the whole a successful effort to treat commercial geography as an educational subject. A chapter is devoted to each of the more important groups of foodstuffs and raw materials, and in most cases, though not in all, the text, which is explanatory as well as descriptive, is illustrated by useful diagrammatic maps. The note on that which shows the distribution of sheep in Australia (p. 65) is however somewhat misleading, as wheat is extensively grown beyond the area in which sheep are most numerous. The author has perhaps been less successful in his treatment of manufactured commodities, and the sections devoted to these are at times rather inadequate. But the book ought to prove useful to those studying commercial subjects in the upper forms at school or in schools of commerce. J. McF.

PROGRESS OF ARCHAEOLOGY. By STANLEY CASSON. *London: G. Bell and Sons* 1934. 8½×5½ *inches;* xii+110 *pages; illustrations and sketch-map.* 6*s*

The author reprints, with additions and alterations, a series of articles which appeared in *The Listener*, in which he makes a rapid survey of archaeological knowledge gained from excavations during the last twenty years. This general view includes work done in Western Europe, Central Europe, and Asia Minor, the East from 'Iraq to India, Greek lands, Etruria, Rome and Italy, Russia, Turkestan, Mongolia, Siberia and China, America and Africa, and is illustrated by over forty excellent photographs. To many classes of readers, and not least to specialists, such careful and cautious summaries are always welcome: the great need of archaeology is more recording on many planes. We have here emphasized new discoveries such as the interrelation of Sumerian and Indian cultures, with a probable contact between 3000 and 2000 B.C., the high literary and artistic culture of the later Saxons, the implements of Pre-Crag man taking humanity back into the Pliocene Age, and the breaking down of the insular aspect of British prehistory. One may mention also a useful short sketch of recent research into Italian prehistory. The big view is refreshing to the worker in limited spheres, and the reading of these pages will benefit many. S. E. W.

LE CRÉPUSCULE DES TRAITÉS. By Y. M. GOBLET. *Paris: Berger-Levrault* 1934. 7½×4½ *inches;* viii+262 *pages; maps.* 15 *fr*

This collection of studies in political geography is not, as might perhaps be expected from the title, a criticism of the peace treaties. Although it treats of some of their provisions, its scope is much wider. It is designed first as an attack upon the German science of "Geopolitik" which enunciates ill-defined general principles and deduces from them a programme of political action coloured by national sympathies. It is also, though to a lesser degree, a criticism of international law, and the fruits of legal theorizing. Like most Frenchmen, M.

Goblet is a realist, pleading for a due recognition of the facts of political geography, territorial, economic, and human, even where the conclusions to be drawn from them conflict with treaty rights or historical prejudices. He argues for example that the citizens of Danzig should freely recognize that before the war their city was rapidly becoming merely a naval station, and that co-operation with Poland would give them a large share in Central European trade.

Similarly, he defends Japan's action in Manchukuo, and the attempt of Bolivia to secure a port upon the Paraguay. He considers that the satisfaction of Bolivia's need for an outlet should not be dependent upon the provisions of older treaties, nor should boundary difficulties in other regions of South America be solved by attempts to interpret royal decrees of the Spanish period. Another section traces recent developments in the countries of the Near East, and analyses the interdependence of British interests therein, as bearing upon the maintenance of British rule in India. In his view, the evolution of a new state in India must be based upon the essential fact that "the English have been there for three centuries."

These essays are clearly and forcibly written, and adequately illustrated by sketch-maps. As the fruit of much reflection and inquiry by an acute and well-informed observer, they are to be warmly commended to all students of present-day affairs, who will endorse his plea for a rational study of political geography.

G. R. C.

THE SPANISH CONQUISTADORES. By F. A. KIRKPATRICK. (The Pioneer Histories.) *London: A. and C. Black* 1934. 9×5½ *inches;* xiv+367 *pages; maps.* 15*s*

Spain was the first modern Power to plant colonies in distant lands and the first to organize a system of colonial government. She did her work so well in some ways that her dominion lasted longer, and died harder, than that of any other colonial Power. What qualifications had Spain, we may ask, for a task which chance gave her? To us, looking back, they do not seem very great. She was neither very rich, with capital to invest, nor very populous, to supply emigrants, nor a great trading nation, wanting markets for her goods. But she had a highly military nobility. The end of the Moorish wars left a crowd of adventurers ready for employment. In America, when once the first explorers had opened the way, there were kingdoms to be conquered and great domains to be granted away. Greedy of fame, of power and of wealth, they eagerly seized the opportunities which the new discoveries offered. To them was due the epic grandeur of the story of conquest in the New World, and no less to them its awe-inspiring combination of heroism and brutality. Spain had too a reformed and zealous Church, ready for a great missionary work. Adventurous monks followed adventurous soldiers, and to the Church in part was due the preservation of the native population. Moreover the precious metals were to be obtained in America. "It was the sacred thirst of gold," writes Adam Smith, "that carried Ovieda, Nicuessa, and Vasco Nugnes de Balboa, to the isthmus of Darien; that carried Cortes to Mexico, Almagro and Pizarro to Chile and Peru." The story of the amazing exploits of these men and of the other conquerors and explorers is admirably summarized by Mr. Kirkpatrick. It is one of the great merits of his book that it comprehends the whole grand story of Spanish conquest in the New World from the first setting forth of Columbus in 1492 to the achievements of Cabrera and Goray in the River Plate region in the later sixteenth century. "With the foundation of Buenos Aires" (1580), he writes, "the vast semicircle of Spanish dominion in South America was complete: the line of empire, in parts broad and solid, in parts narrow but nowhere interrupted, extended from

Paria westward to the Pacific, thence southward along the Andes through New Granada, Quito, Peru, and Chile, eastward across the Pampas to the river Plate estuary, and from the estuary nearly 1000 miles northward up the river beyond Ascensión. This line enclosed an interior frontier measuring 7000 miles, everywhere bordered by savagery, . . ." From this time, whether in North or South America, there was little expansion. "For more than two centuries the prevailing note of the Spanish dominion in both American continents is peace." It was a peace established after tremendous efforts and a terrible destruction of native life. Its justification in the theory of the time was that no pagan could lawfully exercise dominion, but only a Christian. The kingdoms of the heathen were the lawful prize of the children of light.

"That which I esteem most," wrote Cieza de León, in a passage quoted by Mr. Kirkpatrick, "is not the conquests nor battles with the Indians, but the labour of discovery." For that great work the Spanish Conquistadores find their natural place in the Pioneer Histories. They were in fact the greatest of pioneers. Their labours gave to Spain an empire twice the size of Europe. But the opportunities of Spain proved more than she could use, and she sank at last beneath the burden of her good fortune. Of this great chapter of colonial history Mr. Kirkpatrick has given a well-balanced account, comprehensive in its range and sober in its treatment. The book is illustrated by a number of useful maps. E. A. B.

GENERAL

VANISHING CRAFT: British coastal types in the last days of sail. By FRANK G. G. CARR. *London: Country Life* 1934. 11×8½ *inches;* xii+108 *pages; illustrations* (drawings by FRANK MASON). 15*s*

Any one who had the good fortune to be present at the Annual Lecture of the Society of Nautical Research in 1934 must have welcomed the appearance of this volume, so admirably illustrated by Frank Mason. Mr. Carr's work on the Thames Barge has already established his reputation as a writer peculiarly fitted to write on this subject. Starting with the Thames Estuary Craft we find the early history of the Barking Smack. In 1874 the Barking fleet were mostly fishing from Yarmouth and Grimsby. It is not surprising therefore to find at Yarmouth to-day an old inn named the "Barking Smack." The first illustration is "Bawleys off the Nore," which recalls early days of yachting when the home port was Leigh and a sail round the Nore was a delight with the estuary full of Bawleys and Barges with their characteristic sails. We are inclined to agree with the author that "bawley" was originally "bawley-boat," a corruption of "boiler-boat," as the term was first used when these craft were fitted with "boilers" in which the shrimps were boiled as soon as caught. Mr. Wigful however thinks "bawley" was an old Essex term for big, and Fitzgerald's 'Sea words and phrases' under the heading "Bawley-boat" has "Halliwell quotes from Cole 'Bawlin, big'." This seems plausible applied to a craft derived from the Peterboat only larger. The drawing "Essex Smacks, Brightlingsea" depicts two oyster smacks and a big craft of a different type, a large ketch. The latter is of a type already extinct; these vessels dredged for a coarser type of oyster in the North Sea off Terschelling Light. They were locally known as "Shillingers," and a description of the life on these vessels is given by a man who had sailed in them from boyhood. "Open Beach Boats" is the title of a very sad chapter; it describes the complete disappearance of the world-famed Deal luggers. The reviewer recalls so well over fifty years ago endeavouring to portray these boats as they lay on Deal beach little thinking his early efforts if preserved might now be a

record of some interest. Another vanished type is the famous East Coast beach yawls. There is the story of the wonderful *Reindeer* of Yarmouth which challenged the *America* schooner in 1851; she was 69 feet long and is said to have attained a speed of 16 knots on a reach.

Travelling north Mr. Carr describes the coble and its varieties, a characteristic type of open boat which is marvellously adapted to the coast from which it works. In treating of the luggers of the north and east coasts of Scotland in the same chapter as those of West Cornwall the author has been guided by the fact that they have many features in common; and he points out how similar local conditions have evolved similar types of craft in districts so widely separated, although their origins may be in no way connected. We would draw particular attention to the chapter on the Herring Drifters and the Brixham, Ramsgate, and East Coast trawlers. It is still a pleasure to see the Lowestoft fleet of sailing trawlers putting to sea together on a fine morning after Christmas; we must make the most of this sight, realizing that it is inevitable that these fine smacks will shortly be replaced by oil-driven vessels of which three are now on the stocks in this port. Mr. Mason provides us finally with beautiful drawings of a Billy-boy Schooner, a Brig off Margate, a Topsail Schooner, and a Coasting Ketch. Let us hope that this book will arouse lovers of the sea and ships to the danger of leaving the collection of full information on surviving coastal craft until it is too late. H. M. E.

FUNDAMENTALS IN SCHOOL GEOGRAPHY. By OLIVE GARNETT. (Harrap's New Geographical Series. General Editor: R. N. Rudmose Brown.) *London: George G. Harrap & Co.* 1934. 8×5 *inches;* 330 *pages; illustrations and maps.* 6*s*

This book is primarily intended for students in training colleges who will later be engaged in teaching children from six to twelve years of age; but experienced teachers of children of this age, or indeed of any school age, will find a great deal of value and interest to them, for it is a book that bears the mark of the experienced and level-headed teacher. The writer is particularly able in the exposure of many of the weaknesses of much current geographical teaching. On the other hand, excellent advice is given, both in the selection of topics and in their presentation and illustration, upon the lines which may be followed at the kindergarten stage and which lead later to the introduction of geography as a definite subject of the curriculum; in the use of maps and atlases; and in the practical work in connection with the study of the home area.

The book contains sixty-three illustrations, many of which are examples of work done by children themselves. It is a pity that no examples of children's weather observations are included: indeed weather observations by the pupils are hardly mentioned. It is also a pity that an author so well qualified by experience for the purpose, has not given a fuller treatment, amply illustrated, of forms of handwork appropriate for different stages. More might also have been made of the relations between geography and other subjects, especially as at this stage of teaching children draw no hard-and-fast line between one lesson and another, whatever their teachers may do.

There are excellent bibliographies at the end of each chapter. L. B.

GENERAL ASTRONOMY. By H. SPENCER JONES. Second Edition. *London: Edward Arnold & Co.* 1934. 8½×5½ *inches;* viii+438 *pages; illustrations.* 12*s* 6*d*

The first edition of this book appeared in 1922, and it is striking evidence of the advances made in astronomy in the intervening years that considerable parts

of the book have had to be re-written. The Astronomer Royal states in his preface that he has avoided mathematical analysis as far as possible, while yet using mathematical methods of reasoning. The result is to yield an excellent textbook for student or amateur, which also meets the needs of workers in other fields who require from time to time to refer to a textbook of astronomy for certain facts. A full index facilitates the use of the book for the latter purpose.

The more geometrical aspects of the subject, such as the celestial sphere, the Earth and its form, the motion of the planets, the determination of time and of position on the Earth or on the celestial sphere, are all fully discussed. The nature of the planets and their atmospheres, the classification, constitution, and evolution of stars, the galactic system, and the extra-galactic systems are all discussed in an interesting and authoritative manner, while some very beautiful pictures add to the charm of the whole. It is a pleasure to welcome this book, which gives a really authoritative view of the essentials of astronomy, and of its present state of development. D. B.

BIG GAME: Wanderings in many Lands. By H. FRANK WALLACE. *London: Eyre and Spottiswoode* 1934. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* 288 *pages; illustrations.* 8s 6d

In this book—a mixed bag from all over the world—Mr. Wallace tells of chamois in the Alps, boars in Belgium, wolves in Russia, deer in Scotland and New Zealand, takin and burhel in China, kangaroo in Australia, buffalo and lions in the Sudan. He describes his innumerable hunting incidents pleasantly and vividly. In addition he has a chapter on the preservation of big game. He insists that only by the establishment of National Parks in Africa can the permanent preservation of many species be ensured. The present system of Reserves, though extremely valuable, is not in itself a final solution, since the Reserve is merely a temporary arrangement while the National Park is a permanent institution. The author lists the species in greatest danger of extinction, and summarizes the conclusions arrived at by the International Conference for the Protection of the Fauna and Flora of Africa held in London in November 1933. Of the illustrations one will specially appeal to sportsmen: a page from the author's game-book covered with the autographs of prominent hunters, many of whom have passed away. R. W. G. H.

THE MONTHLY RECORD

BRITISH EXPLORATION OF THE SAHARA

A portion of the British section of the Exposition du Sahara held last year in Paris at the Palais du Trocadéro, which was prepared by the Society under the direction of the Hon. Francis Rodd, is now being shown in the Ambulatory. Many of the exhibits, particularly those associated with Major Rennell, are from Mr. Rodd's collection. By bringing together original documents, maps, books, and photographs an attempt has been made to demonstrate how much of the opening up of the Sahara was due to British initiative. Hornemann, the earliest traveller, who under the direction of the African Association attempted to cross the Sahara from Murzuk, is represented by an autograph letter to Sir Joseph Banks, dated "Mursuc, 6 April 1800," one of the last to be received from him, and by the map of his route prepared by Rennell with MS. comments by the latter.

Another interesting exhibit is a note by Rennell inserted in a volume of the Proceedings of the African Association, commenting upon the results of Laing's journey in West Africa, and recording a journey to Timbuktu in 1764, made by a native at the instance of the English Governor of Senegal, who thus established the eastward direction of the Niger. The achievement of Major Laing, the first European in modern times to reach Timbuktu, is represented by photostat copies, obtained from the Public Record Office, of a route-map of the beginning of his journey, a sketch from his journal, and the last letter which he wrote from Timbuktu in 1826 to Consul Warrington, shortly before his murder. With these is a photograph by Mr. Rodd of the house in which Laing lived at Timbuktu.

A number of documents deal with the expedition of Denham, Clapperton, and Oudney in the years 1822–1824, the first European crossing of the desert. In addition to letters from all three explorers, there are Denham's journal and sketches of the route to Lake Chad, a letter from Warrington discussing the proper conduct of such expeditions, and a sketch-map of the Niger in Arabic with comments by Denham. This was probably supplied by Sheikh Muhammad of Ghadames, who also told Denham that about 1822 a boat manned by eighteen Englishmen had reached Timbuktu. No other record of this expedition has been found. Other items deal with the journeys of James Richardson, Barth and his companions, and Rohlfs. Two sheets of the original drawing of the map of Aïr made by Mr. Rodd in 1927 are also shown. No attempt has been made in this exhibition to illustrate the exploration of the Libyan desert.

A NOTE ON PRINTING AND MAP-LETTERING

One had hoped to see in the Royal Academy Exhibition of "British Art in Industry" some appreciation of the last twenty years' great improvement in printing types; and even of the later interest in map-lettering. For printing is the one industry in which, thanks largely to the Monotype Corporation and its adviser, Mr. Stanley Morison, beauty has gone hand in hand with mechanism. To see what has happened one need only compare the appearance of this *Journal* of twenty years ago with that of to-day. The "Imprint" character in which the *Journal* is now set was the first of the new designs cut for the Monotype composing and casting machines, and has not been surpassed for plain straight-forward scientific printing. The present style of the *Journal* owes much to the advice of Mr. Morison some years ago.

At the Exhibition of British Art in Industry there are many hundreds of books and much fine printing: but not much indication that any one is interested in

commercial printing as an art. The show pieces are from private presses at fancy prices. Half the books at least are shown shut, for their jackets, their covers, for anything except their type, margins, and paper. More disappointing still is the almost complete neglect of maps. There is one Ordnance Survey Sheet (but not one with the beautiful new lettering) employed as a lining paper for a case of books which lie about upon it; there is one commercial chart, of the style consecrated to charts in the middle of last century; there is one atlas open, showing a map of style about 1870, and one shut; there are a few maps for travel books, rather wilfully mediaeval; and a jacket or two more deliberately archaic. No one would gather from this exhibition that any one had given thought in the last ten years to the beauty or the legibility or the economy of map lettering: yet there are in these fields some valuable if seemingly unappreciated fruits of British Art in Industry.

A HIGH FALL IN BRITISH GUIANA

The Secretary of State for the Colonies has kindly directed that a report announcing the discovery of a high Fall on the Ipobe river in British Guiana should be sent for the information of our Society.

During a geological survey in May 1934 a high Fall was sighted from a distance of about 15 miles by Mr. S. Bracewell and Mr. P. A. Forte, and was at the time mistaken for the Kaietur Fall; but doubt having arisen when its bearing and distance were further gone into, it was decided to ascertain its true position during a flight over the Siparuni–Mazaruni area arranged for November last. The machine was on this duty after flying from Kaietur to the Amaila Fall on the Kuribrong river, turned back south and located the new Fall 12 to 15 miles north of Kaietur, on the Ipobe river, a tributary of the Kuribrong. The rivers were especially low at the time, and the volume of water from the Fall was less than when it was seen in May. From a height of about 2000 feet the Fall appeared to be from 50 to 100 feet wide, and to have a vertical drop of about 500 feet. It so happened that it was located about midday on November 29, the date of the marriage of H.R.H. the Duke of Kent. The Survey party reported that no Indian name is known for it, and that the Kuribrong district has no aboriginal population. They accordingly suggested that the Fall might be named appropriately "The Princess Marina Fall." In forwarding their report to the Colonial Office the Acting Governor of British Guiana supported the suggestion.

The Secretary of State was not unmindful of the principle that in general it is preferable that geographical features should bear native names, but having in view that precedents exist for giving non-native names to other well-known waterfalls, he decided that the circumstances of the present case required that attention should be paid both to the compliment intended by the name proposed and to the loyal sentiment which actuated the suggestion. The proposal was accordingly submitted to Her Royal Highness the Duchess of Kent with the suggestion that the Fall should be given the name "The Marina Fall," and Her Royal Highness having intimated her pleasure in accepting this suggestion, the Acting Governor of British Guiana has been so informed.

A JOURNEY IN EASTERN PERU

A journey through a little-known area of eastern Peru is described in a recently received number of the *Boletin* of the Geographical Society of Lima (vol. 59, 1933, pp. 130–48). The author, Mons. S. Golewski, a Polish engineer, crossed in 1931 the "Gran Pajonal," an area lying between the rivers Alto Ucayali and Perene. The first to penetrate here was the Franciscan Juan de la Marca in 1729. During some years afterwards missions were established, but these were finally destroyed by the Indians, and few travellers have since visited it.

M. Golewski's object was to endeavour to relieve the misery of the tribes by opening up a route through their country. By patience and diplomacy he succeeded in overcoming the hostility with which he was generally received, on one occasion by performing with a pair of scissors a minor operation upon a wounded Indian. The chief difficulty encountered was in obtaining supplies, for the tribes of the Gran Pajonal support themselves upon fungi, birds' eggs, toads, and similar reptiles. In some places it was also difficult to obtain water.

His point of departure was Chicoya, on the Alto Ucayali, whence he struck south-westwards. The first part of his route, over the *cerros* from which the tributary streams flow, was difficult: the higher slopes are covered with small trees, brush, and a thick carpet of moss, and at nights the cold was severe. The Gran Pajonal is a great, undulating *llanura*, at first sight suggesting an amphitheatre set in the midst of hills; structurally however it is a *meseta*, and the source of many streams. The writer concludes that it is a dried-up lake bottom, the surface consisting in part of humus, in part of a layer of sandy permeable soil about 4 metres in depth. He attributes the absence of trees largely to the aridity of this subsoil. The altitude of the Pajonal is about 1280 metres, and M. Golewski comments upon the exhilarating effects of the bracing air and sunlight after the forests previously traversed. After a journey of some twenty days, he reached the Peruvian Corporation settlement upon the Rio Perene. The account of his journey gives the names of the rivers, Indian tribes, and settlements which he encountered; the sketch-map is on too small a scale to be of any service.

NATURAL DIVISIONS OF AUSTRALIA

Professor Passarge gives a very condensed summary of the results of his recent work on the natural divisions of Australia in *Petermanns Mitteilungen*, vol. 80, 1934, pp. 254–256. He had undertaken the regional subdivision of Australia for a forthcoming work on 'Geographische Völkerkunde,' but the result of the application of his principles of *Landschaftskunde* was unexpected. The map (No. 3) did not meet the requirements of ethnology. This paper was therefore prepared, mainly in order to develop the principles of *Landschaftskunde*, and only incidentally as a contribution to Australian geography. The text is brief, a great deal of information is summarized in the four maps, and the matter is controversial. Adequate criticism within the space of a note is hardly possible, and comment must be confined to the Australian aspect of the paper. But it is only fair to state that Professor Passarge so developed his method as to produce a map of the kind required by 'Geographische Völkerkunde.'

The present maps, reproduced on the scale of 1/30 M, are too small for any but the most general representation. The first, of the climatic provinces, is no more useful for general purposes than the official maps of mean annual rainfall, and it fails to display the monsoon regions of the north and the Mediterranean regions of the south. Its preparation led however to the recognition of an important feature of Australian climate, the oscillation of the climatic zones. What Passarge has to say should be compared with Bowman's paper on "Our expanding and contracting desert" in the *Geographical Review* (vol. 25, 1935, pp. 43–61). The third map, *Die Landschaftsgürtel*, should be instantly comprehensible to those not versed in the use of Passarge's method, if it be regarded as a map of types of country distinguished mainly by climate and vegetation. The types distinguished are: rain forest, rainy steppe and sclerophyll woodland (one zone), dry steppe, saline steppe, and desert. This map is a most useful addition to Australian geography, for it does away with the confusion between desert climate and desert country. The saline steppe, which has everywhere a cover of vegetation, occupies a very large area; and undeniable desert, practically bare

of vegetation, three relatively small ones. The second map, of the botanical regions, based mainly on Geisler's work, adds little to existing knowledge. The fourth, of natural regions appropriate to the study of the aborigines, was derived apparently from the first and second, but no account is given of the principles upon which it was constructed. Superficially it does not appear to correspond very well with our fragmentary knowledge of the distribution of aboriginal tribes, languages, or systems of descent, though it may prove to be of considerable use in the study of totemism.

Professor Passarge makes the fourth map the *point d'appui* for a further development of his method, and upholds it as proof of distinctions too involved to be considered here. For the sake of those interested in *Landschaftskunde* however it seems necessary to say that the map implies a clear distinction between *kulturelle Landschaftsgliederung* and the *Kulturlandschaft*. M. A.

RAINFALL MAP OF THE WORLD

In *Petermanns Mitteilungen* (1934 Heft 1) Dr. W. Meinardus presents a map which he describes under the title "Eine neue Niederschlagskarte der Erde." The map is drawn on the equatorial equal-area projection to the scale 1 : 100,000,000 and shows the distribution of precipitation in six colours representing average annual amounts from under 25 cms. (10 inches) to over 300 cms. (120 inches). For the rainfall over the oceans the author relies on the work of Supan and Schott. The map is accompanied by a discussion on world hydrology, according to which the land surface of the globe, with an average rainfall of 67 cms., receives 19 per cent., and the sea surface, with 114 cms., 81 per cent. of the Earth's total precipitation expressed in cubic kilometres. Since the respective surfaces measure 29 and 71 per cent. of the area of the globe the sea receives proportionately more rain than the land. Dr. Meinardus regards this as a not very surprising result of higher humidity over the sea and the compensation of large local excess of rain in mountains by deficiency in their rain-shadows. It is not unlikely however that the rainfall over the sea has been over-estimated. Direct measurements of rainfall over the sea are scarce: limited, in fact, to those taken on research vessels, and most of the figures used for representation of oceanic rainfall have been estimated from comparisons with neighbouring islands or coasts with the assistance of qualitative weather data in ships' logs and of salinity observations. Oceanic islands receive, as a rule, heavier rainfall than the open sea, especially in low latitudes, where they form centres for convectional activity.

Dr. Meinardus, following Wüst, takes the annual discharge of water from the land into the sea as 37,100 cubic kilometres. From this he deduces an average yearly evaporation over the land of 42 cms. and over the sea of 124 cms.—three times as much. Although the latter figure is considerably above that obtained either by Wüst or Schmidt for evaporation over the sea, Dr. Meinardus thinks that the preliminary results of evaporation observations carried out on the *Meteor* expedition point to his higher figure being justified both on experimental and theoretical grounds.

SNOWFALL IN NORTHERN EUROPE

In *Petermanns Mitteilungen*, Hefte 3 und 4, 1934, Dr. A. Peppler and F. Hummel discuss snowfall in a region of Northern Europe under the title "Die mittleren und maximalen Schneehöhen in Skandinavien, Finnland und im Ostbaltischen Gebiet." The data cover 20 to 25 years' observations at 120 stations over an area including Norway, Sweden, Finland, the new Baltic States and neighbouring parts of Russia, but no information is forthcoming from Denmark. The average snowfall depths are set out in tables and on maps for each of the six months November to April as well as for the half-year. The lines

representing equal depths of snow are stippled across the very snowy mountains of Scandinavia; but in any case they must be misleading, partly because of the paucity of observing stations, all situated at low levels, and partly because of the close dependence of snowfall on local conditions of altitude and exposure. In the plains the smallest snowfall in the whole area occurs in southern Sweden where the average depth in January, the month of greatest thickness, is less than 10 centimetres (4 inches); the largest occurs in Lapland and the lake district of eastern Finland where the depth reaches a maximum in March of 80 cms. (32 inches). In any particular year however the maximum depth in Lapland and the far north may not be reached till May, whilst in the milder maritime regions of irregular snowfall in the south there may be most snow as early even as October or as late as May.

Perhaps the most interesting facts in the distribution of the average snowfall relate to the contrast between the western and eastern shores of the Gulf of Bothnia, the northern and southern shores of the Gulf of Finland, and the northern and southern of Lake Ladoga. Thus the average depth of snow for the six months in question on the western side of the Gulf of Bothnia is 27 cms., on the eastern 22 cms., and on the northern side of the Gulf of Finland 30 cms., in comparison with only 8 cms. on the opposite side. A map showing in some detail the distribution both of snowfall and mean temperature for December indicates that the snowy sides of these gulfs and lake are about 6° C. colder than the other sides. It is explained that the relatively warm surfaces of such bodies of water produce lower barometric pressure towards which converge warm moist winds from the south and intensely cold dry winds from the north. The warmer winds which may even bring rain to the southern shores of Lake Ladoga and the Gulf of Finland, or the eastern shore of the Gulf of Bothnia, meet the very cold polar air and rise over it with rapid condensation of their moisture into copious snowfalls on the opposite shores.

In view of the important economic and meteorological effects (scenic effects might also be added) of a snow-cover the authors of this paper regret the general neglect of snowfall study in most countries where snow is simply measured as part of the rainfall; they point out that even in a polar climate like Greenland adequate records for long-established meteorological stations are wanting. It may be noted however that maps giving average depth and duration of snow-cover exist for several countries including Canada, the United States, Russia, and Germany. In the British Isles the large proportion of rain in the winter precipitation may have tended to discourage systematic snowfall observations which are meagre; but a general account of outstanding snowy periods and severe drifting snowstorms in various localities since 1875 is given by Mr. L. C. W. Bonacina in a paper published in *British Rainfall* for 1927.

COMPASS DEVIATION OF A SHIP STRUCK BY LIGHTNING

We have received from Captain F. Clegg, Master of the S.S. *Boma* of the Elder Dempster Line, an interesting letter dated 22 November 1934. On November 13 in lat. 41° 0′ 59″ N., long. 10° 0′ 09″ W., during a hard squall, the ship was enveloped in a vivid flash of lightning with what sounded like the burst of a high explosive shell overhead. The steering compass oscillated over an arc of about 180°, finally settling down 28° off the compass course, while no alteration had occurred in the standard compass. On November 17, off Grand Canary, the ship was swung and the deviations obtained on both compasses, the standard compass being quite unaffected, but the steering compass considerably disturbed on all points. The steering compass was then compensated with some difficulty and reduced to a small residual deviation. 3° E. on an easterly course

was the greatest error showing, and this remained constant during the voyage to Freetown. It was found after the storm that half the fore-truck had been broken off and two valves in the Marconi set had been destroyed, but otherwise no damage appears to have been done to the ship. The letter with complete details of the deviations and subsequent compensation was submitted to the Hydrographic Department of the Admiralty, and the Director of the Compass Department reports to the Hydrographer that it is unusual that the maximum effect of the change in deviation should be developed on the east. He recalls that H.M.S. *Veteran* was struck by lightning in October 1926 and a deviation of 80° appeared at the steering compass, the standard being unaffected. The error of the compass gradually decreased in the next two years, and the ship then resumed her original magnetism. It is hoped that the Master of the *Boma* will keep a record of the subsequent history of his compasses.

MEETINGS: SESSION 1934–35

Fifth Evening Meeting, 21 January 1935. The President in the Chair

Elections: William Baddeley-Adams; Allan Beresford Baddeley; Robert Harding Bolam, B.A.; The Right Hon. the Viscount Carlow; Patrick Ashley Cooper; Joseph William Hadfield Craven; Mrs. Alice Fairlie Culverwell; Robert MacDonald Guthrie; William Cecil Hall, B.SC.; Miss Katherine Gaskell Harvie; Thomas Henry Inkster; Miss Mary Alice Jackson; K. Kandish; Archibald Laurence Lyall; Maurice Marcus; Patrick Reuben Matthews; Captain Colin Knox Muspratt; Geoffry Alexander Stafford Northcote; Geoffrey Frank Dennis Pearson, M.A.; The Rev. James Gibson Philip, M.A., F.R.S.A.; Miss Violet B. L. Phipps, B.SC.; Preston Pilbin, B.SC.; The Baroness Ravensdale; Frederick William Titterington; Miss Lova Kathleen Trotter; Donald Van den Bergh, J.P.; Miss Christina Wanklyn; George Wardle, F.Z.S.; Sir Norman James Watson, Bart.; Sidney Morgan Williams

Paper: The British Trans-Greenland Expedition of 1934. By Mr. Martin Lindsay

Sixth Evening Meeting, 4 February 1935. The President in the Chair

Elections: Mrs. Mary Olive Barron, B.A.; Francis Wilfred Paul Corbould; Harold Douglas Cotton; Gwilym John Davies; MacDonald Gill, F.R.I.B.A.; William Battery Grassby; Dr. Raymond Greene; D. L. Leach; John Henry McNeile; Percy L. Mathews; William McCarter Meek; G. Milne; Adam Franklin Reifsnyder; B. S. Roberson, B.SC.; Barnard H. John Vandieren

Paper: Nanda Devi and the Ganges Watershed. By Mr. Eric Shipton

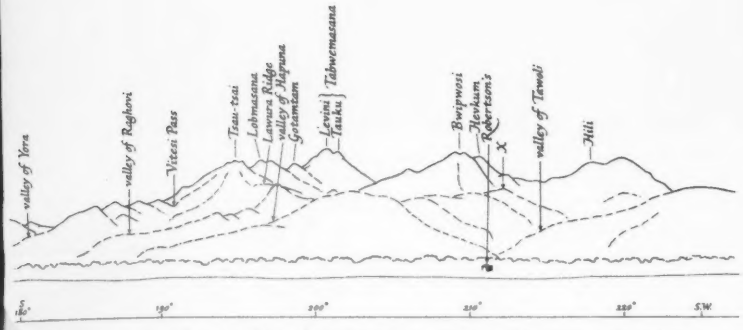
Fourth Afternoon Meeting, 11 February 1935. The President in the Chair

Paper: The Movement of Desert Sand. By Major R. A. Bagnold

Seventh Evening Meeting, 18 February 1935. The President in the Chair

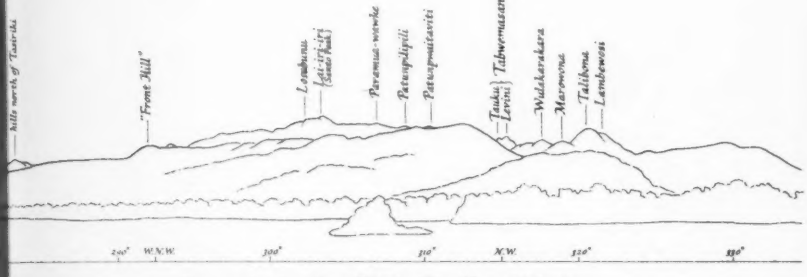
Elections: Harinarayan Girdharlal Acharya, B.A., F.Z.S.; Charles Wicksteed Armstrong; Commander Harold Shedden Stanley Browne, R.N.; George Herbert Byfield; Major Harry G. Davis; Frank Lambert Dawson; Alfred Charles Ellis; Henry William Erving; Mrs. M. E. Goad; Miss Alice Jones; Kenneth Beaumont Kilner; W. J. Kydd; Austin Bruce McGee; Captain Hugh Alexander Doull Mackay; The Rev. Henry Edward Lemuel Purcell, T.D., F.Z.S.; Charles Whittuck Rabbits; William Edward Ramsden; S. Selvanayagam; The Rev. Arthur T. Slater; George A. West

Paper: The Islands of Lake Tana. By Major R. E. Cheesman



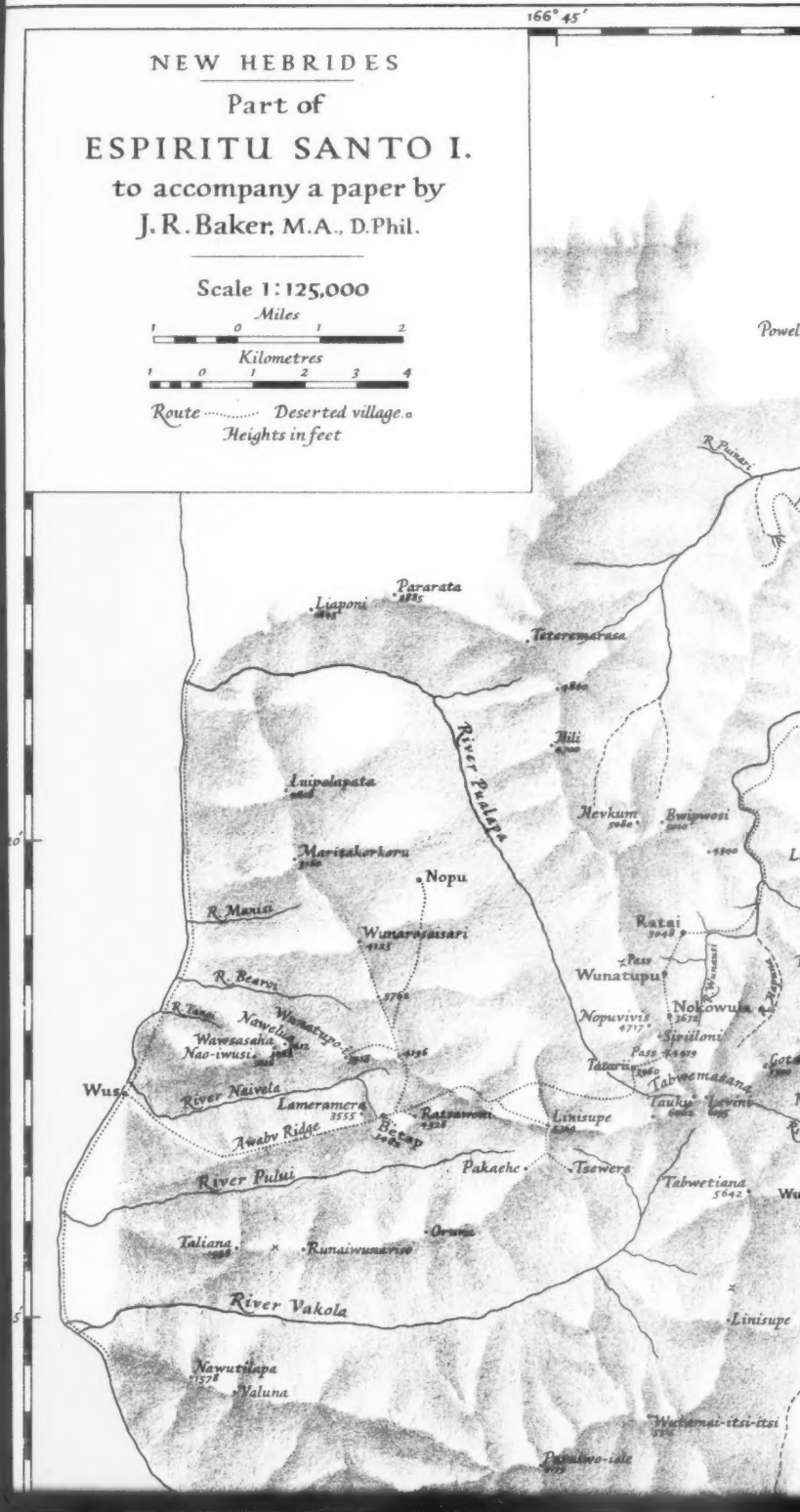
Panoramic view from St. Philip & St. James Bay, 1 mile off Robertson's plantation.

Vertical scale exaggerated 1⅛ times.



Panoramic view from Mission Pier, Tangoa Island.

Vertical scale exaggerated 1⅛ times.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Part of
ESPIRITU SANTO I.
to accompany a paper by
J. R. Baker, M.A., D.Phil.
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Siriuloni
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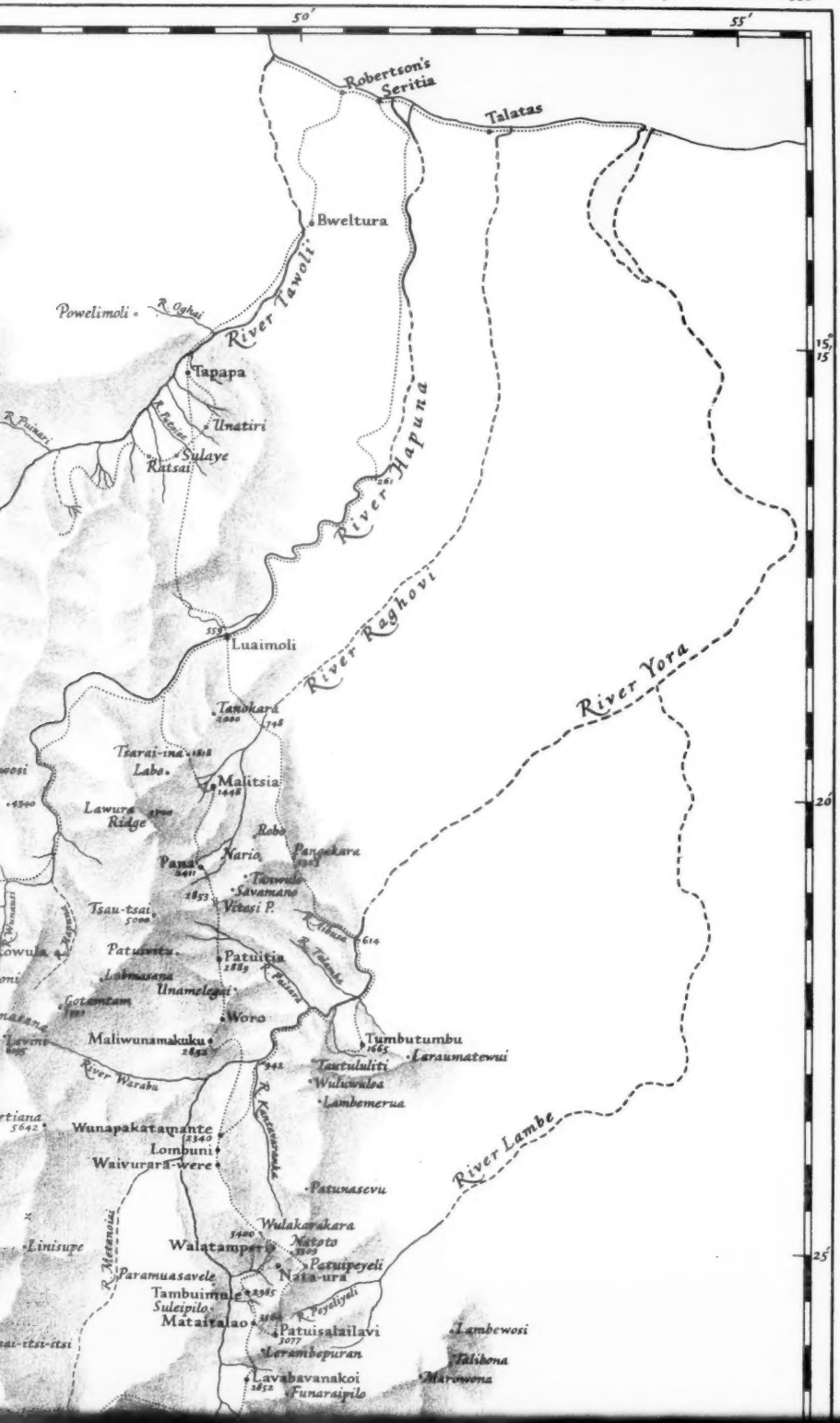
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Tsau-tsai
Savamano
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Patuisitu
Patuitia
Lobmasana
Unamelegai
Gotomtam
Woro
Maliwunamakuku
River Waraba
Tumbutumbu
Laraumatewui
Tautululiti
Wuluwuloa
Lambemerua
Wunapakatamante
Lombuni
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Patunasevu
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ESPIRITU SANTO I.

to accompany a paper by
J. R. Baker, M.A., D.Phil.

Scale 1:125,000

Miles
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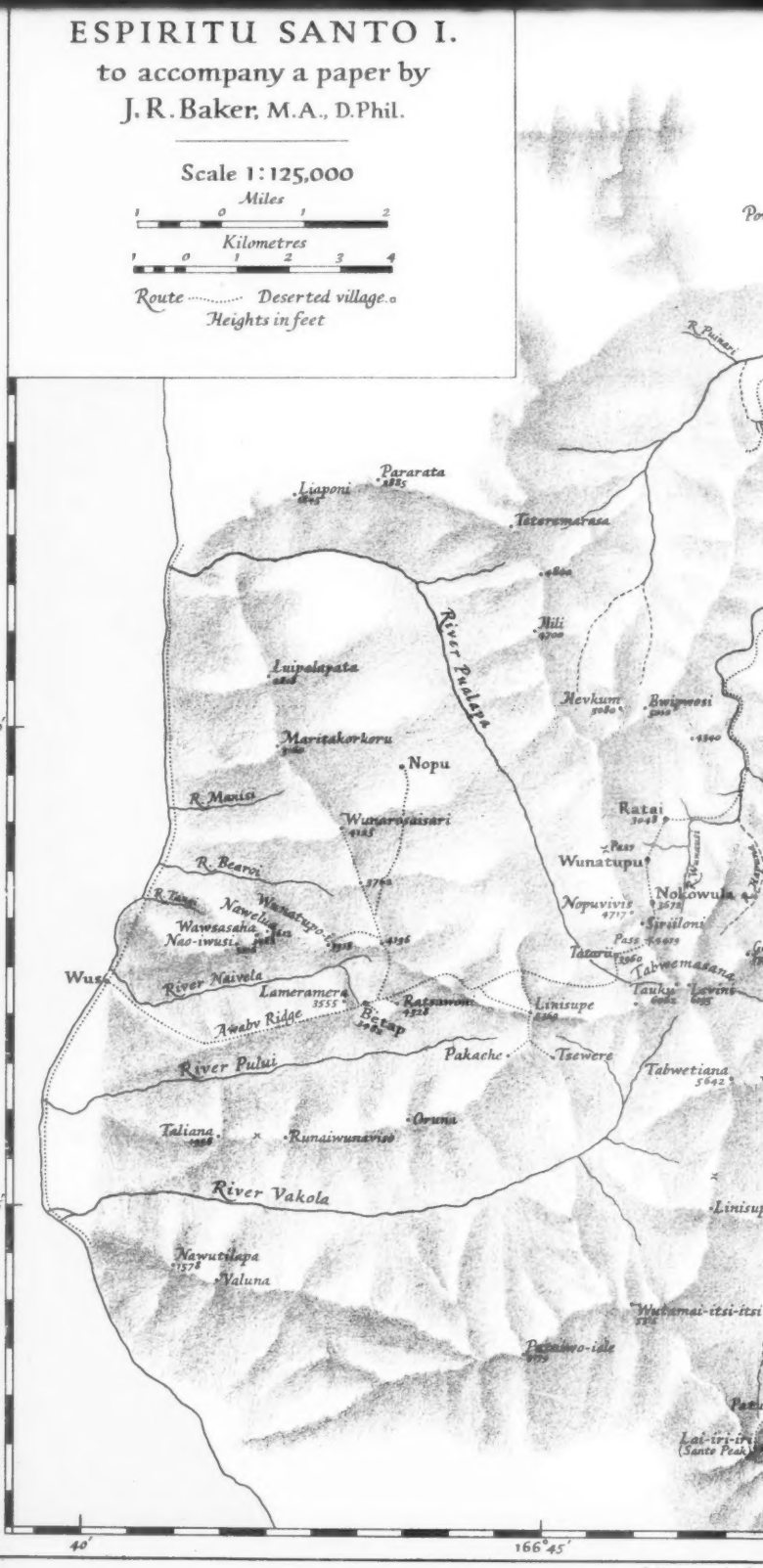
Route ..... Deserted village.o
Heights in feet



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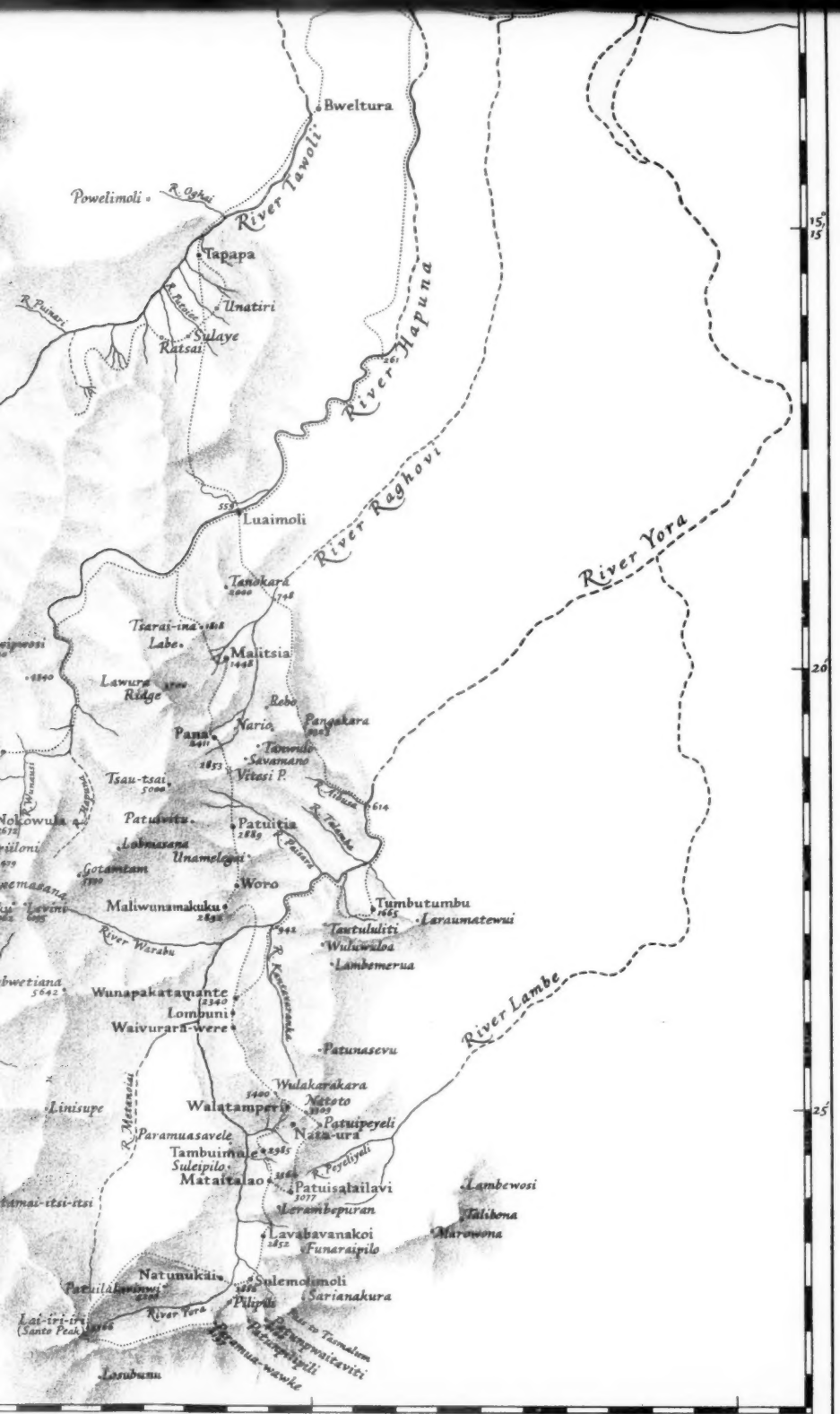

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Baker